THE ACADEMIC ICT GAP

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AACU	Association of American College and Universities	64
ABS	Australian Bureau of Statistics	21
ACARA	Australia Curriculum, Assessment and Reporting Authority	125
AGBUC	Association of Governing Boards of Universities and Colleges	20
ARPANET	Advanced Research Projects Agency Network	32
BASIC	Computer programming language	36
BLOGS	Web-logs: User generated content and dialogue	40
BOSTES	Board of Studies Teaching & Educational Standards NSW	2
BYOD	Bring your own device: P-12 program using student-provided hardware	123
CAI	Computer-Aided Instruction	29
CALL	Computer-Assisted Language Learning	6
CBMS	Conference Board of the Mathematical Sciences	33
CIS	Council of International Schools: School placement and vetting group	17
CMoE	Chinese Ministry of Education	14
CMS	Content Management System	6
CNNIC	China Internet Network Information Center	57
COBOL	Computer programming language	36
CSIRO	Commonwealth Scientific and Industrial Research Organization	40
CTRL	Control: a Command Key on a standard PC keyboard	9
DEEWR	Department of Education, Employment and Workplace Relations	74
DOD	United States of America Department of Defense	29
ECAR	UNESCO's EDUCause Center for Analysis and Research	65
ECDL	European Computer Driver's License	77
EFA	Exploratory Factor Analysis: Statistical analysis methodology	82
ENIAC	Electronic Numerical Integrator And Computer: 1st general-purpose PC	29
ESL	English as a Second Language	63
ETS	Educational Testing Service	64
GPS	Global Positioning Satellite	3
GUI	Graphical Use Interface	36
HREC	University of Tasmania Human Research Ethics Committee	75

Acronym Abreviation	Definition	Page
HTML	Hyper-text Mark-up Language	4
IB	International Baccalaureate: P-12 school curriculum	63
IBM	International Business Machines	28
ICEF	International College of Economics and Finance	16
ICT	Information and Communications Technology	1
IELTS	International English Language Test System	15
IGCSE	International General Certificate of Secondary Education	63
IIE	Institute of International Education	12
ILS	Integrated Learning Systems	38
IMF	International Monetary Fund	11
ISC	International Schools Consultancy Group	60
ISD	Instructional Systems Design	66
ISTE	International Society for Technology in Education	23
JPG	Joint Photographic Experts Group	40
KMO	Kaiser-Meyer-Olkin: Statistical analysis test methodology	91
L/CMS	Learning/Content Management Systems	6
LMS	Learning Management Systems	7
MATLAB	Mathematics Laboratory computer learning application	6
MESDC	Main English-Speaking Destination Countries	18
NAPLAN	National Assessment PLAN	125
NEPMT	Australian National Education Performance Monitoring Taskforce	48
NSFNET	National Science Foundation Network	37
OECD	Organization for Economic Co-operation and Development	11
PC	Personal Computer: Publically-available desktop computer	5
PCA	Principal Components Analysis: Statistical analysis methodology	92
PDF	Portable document format	39
PDP	Personal-Data-Processor: Early computer	32
PIE	Professionals in International Education: Online media groups	60
PRC	People’s Republic of China	12
RAM	Random Access Memory: PC memory storage and access system	10
RMIT	Royal Melbourne Institute of Technology	75

Acronym Abreviation	Definition	Page
ROM	Read-Only Memory: PC memory management and retrieval system	38
RPS	Research Production Skills: advanced ICT skills	2
RSK	Republic of South Korea	30
SAT	Scholastic Aptitude Test: University admissions test program	55
SIP	Suzhou Industrial Park: International business development	54
SLO	Student Learning Outcomes	94
SPSS	Statistical Program for the Social Sciences: data analysis methodology	6
SSIS	Suzhou-Singapore International School	54
STEM	Science, Technology, Engineering and Mathematics	14
TCP	Transmission Control Protocol: Internet standard for information transfer	32
TEFL	Teaching English as a Foreign Language	17
TEKS	Texas Essential Knowledge and Skills	2
TESOL	Teachers of English to Speakers of Other Languages	64
TOEFL	Test of English as a Foreign Language	15
TQM	Total Quality Management	18
UIS	UNESCO Institute for Statistics	11
UNESCO	United Nations Educational, Scientific and Cultural Organization	11
URL	Uniform resource Identifier	42
USA	United States of America	12
USB	Universal serial bus	3
USSR	Union of Soviet Socialist Republics	31
VPN	Virtual Private Network	42
WWII	World-War Two	30
WWW	World-Wide-Web	40
WYSIWYG	What-You-See-Is-What-You-Get: PC immediate-response editing program	36

Abstract

"Technology is no longer just a tool, it is an environment". *(Cofino, 2009)*

This study investigates the Academic ICT Gap that exists between the information and communications technology (ICT) skills required by Western universities and the ICT skills of commencing foreign students educated in developing countries. Commencing students and university instructors have expectations that are at odds. ICT are ubiquitous in Western higher education and all incoming students are expected to have mastered the basic ICT that support both coursework and the learning and content management systems students use daily for academic and administrative purposes. Yet there is no uniform ICT instruction in the foreign primary through secondary (P-12) schools in which many of these students are educated. Higher education is a competitive and profitable global service-sector driven by supply and demand and the foreign student market brings unique challenges. Commencing foreign students expect their new institutions to teach the ICT they need: similar to the practice of providing remedial English-language services. By accepting students with ICT skill discrepancies, institutions accept the onus of ICT remediation.

This study takes the initial step in defining the Academic ICT Gap. The Survey of Higher Education asked 353 Australian university instructors to rank the importance of 28 ICT items to their coursework. The Survey of Primary through Secondary asked 135 pre-tertiary International teachers to review these same 28 ICT items and indicate their students' graduate mastery levels. A comparison of survey data identified discrepancies in a range of important skills required for academic work.

Among the myriad uses of this unique research is the creation of the Academic ICT Baseline, a transparent tool, created by Western universities, to guide ICT curriculum in International P-12 education.

Keywords: Academic ICT Gap, Academic ICT Baseline, ICT, L/CMS, Research Production Skills, RPS

1 THE EFFECTS OF THE DIGITAL DIVIDE ON GLOBAL LEARNING

"Do you think me a learned, well-read man?"
"Certainly," replied Zi-gong. "Aren't you?"
"Not at all," said Confucius.
"I have simply grasped one thread which links up the rest."
(Sima Quan as quoted in Jung, 2006, p. 1)

1.1 The problem: The *haves* and *have nots* remain academically divided

The first use of the term *Digital Divide* is difficult to determine. The United States Department of Commerce, a former president and a host of international speakers and dignitaries claim credit as the alliteration alone made the term *a natural* for media sound bites. Whether it was applied to a country, a geographic area or a geopolitical region, the Digital Divide is defined as the *Digital Gap* that separates those with access to the Internet (*haves*) from those without (*have nots)* (Selwyn, 2010). The *haves* countries tend to be developed; economically and politically secure. The *have nots* are not. The *haves* countries are *wired;* the Internet is openly available on state-of-the-art infrastructure provided by trained professionals across all levels of government, commerce and education. In the *have nots* countries the opposite is true. ICT production skills were made available to *haves* businesses and academics circa 1980, and were quickly adopted, repurposed and adapted (the Journal, 2013). But again, this did not occur for the *have nots*.

But this definition of the Digital Divide quickly proved too simplistic. As more people started using the Web for communication and information retrieval, it became less useful to merely look at the binary classifications of Internet accessibility and who is online when discussing questions of inequality in relation to the Internet (DiMaggio & Hargittai, 2001, p. 8). By 2001, Hargittai's research had identified five dimensions of Internet penetration that deserved study: equipment, autonomy of use, skill, social support and purpose of use. In 2002, she suggested a subgroup to the Digital Divide, the 2nd Level Digital Divide. Based on the availability of access to Internet connectivity, the 2nd Level Digital Divide was defined by the *have* and *have nots'* online digital access and their abilities to use this access or *skills* (Hargittai, 2010, p. 1). The 2nd Level Digital Divide *haves*, persons living in Internet-connected countries, are able to buy and sell, locate and research, chat and blog and, in general, politically and socially connect with the world, supported by *haves* governments. *Have nots'* countries remain disconnected. This disadvantage means the *have nots* are less apt to be ascommercially competitive, economically advanced, educationally up-to-date and globally invested (Bertot, 2003, p. 187) as their *haves* counterparts.

The Academic ICT Gap

However, the *have nots* continue to make digital advances in economics and education within their given limitations. ICT has three distinct yet synergistic components: information, communications and technology, which include but are not limited to, the 2nd level online skills as defined by Hargittai (2010). Internet connectivity may be required to disseminate information but it is not required to create the documents that allow a person to become an active participant in shaping thought, advancing a cause, arguing a position, presenting a critical opinion or defending a stance. These academic and commercial endeavors have offline common denominators: command of language, critical thinking and communication skills. However, higher education requires a range of skills: from academic writing to advanced research production skills (RPS).

Historically, ICT became a component of conventional English-language learning in the 1980s and 1990s, and it introduced a radical change in the language teaching practices and theories. The shift to communicative language teaching changed the role of technology in the field (Maryam, Ahmad, Elham & Nasrin, 2013, p. 46) As a result; both English and ICT have become essential literacy skills for non-native speakers of English to ensure their full participation in the information society (Jung, 2006, p. 1). RPS have also become important learning tools: including 3D and multimedia applications, emerging and bespoke programs and applications, some commercially designed for use in specific fields of study. Student mastery of such bespoke RPS may be required to secure post-graduate employment. Table 1 list 21 ubiquitous ICT software, hardware and Internet interactives that students in Texas, New South Wales and the United Kingdom (UK) are introduced to at various levels of primary through secondary school (P-12) curriculum and that they will use daily in higher education (BOSTES, 2014; Murphy, 2001; & TEKS, 2013). These ICT support important learning achievements such as language adaptation, study and time management, work flow and production, academic research and data management. Mastery is required to conduct and produce the rigorous research expected in higher education and commerce. How these ICT are used is not static. Learning environments encourage repurposing of ICT, however in Table 1 they are cross-referenced by their more common usages. Table 1, columns 1 and 2, indicate if the ICT requires Internet access in order to provide basic functionality.

The Academic ICT Gap

Table 1: ICT students will use daily in education

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Offline Access	Online Access	SOFTWARE	Language Adaption	Document Creation	Presentation Skills	Time Management	Photos/Image Manipulation	Audio/Sound Manipulation	Video Creation & Inclusion	3D Animation & Modelling	Web Design & Maintenance	Data Sharing & Transport	Connectivity & Networking	Programming Languages	Computer Science
x		Office suites	x	x	x	x					x	x			X
x		Graphics Presentations		x	x		x	x	x	x	x				X
x		Audio/Video editing			x			x	x	x	x				x
	x	Web develop/editing	x		x			x	x	x	x		x	x	x
		HARDWARE													
x		Desktop/laptops	x									x	x		x
x		External/USB drives										x	x		
x		Interactive whiteboards	x	x	x							x			
x		SD cards/readers										x	x		
x		Printers/copiers/scanner			x								x		
x	x	Smart phones	x	x			x	x	x			x	x		
	x	Tablets/eReaders	x	x	x			x				x	x		
x	x	Webcams/microphones			x			x	x		x		x		
x	x	Wireless/Bluetooth						x	x				x		x
		INTERNET INTERACTIVES													
	x	Information sourcing	x	x		x	x	x	x						x
	x	Search engines	x	x	x	x	x	x	x	x	x	x			x
	x	R&D storage/retrieval	x	x		x						x	x		x
	x	Media streaming					x	x	x		x		x		
	x	Social media/forums	x	x			x	x	x		x	x			
	x	Video conferencing	x	x	x	x			x			x	x		x
	x	Language translation	x	x		x					x	x			x
	x	GPS mapping locations			x			x	x	x			x		

(Price, 2006)

1.2 Information and Communications Technology - common knowledge

The abbreviation ICT stands for information and communication technology or, alternatively, information and *communications* technology. The differing number of the word 'communication' is significant in that the singular form is concerned with human interaction while the plural is generally taken to refer to the whole field of data communications infrastructure. At its simplest, the former or singular form is the process or outcome while the latter or plural is about the technology itself (Lloyd, 2005, p. 3). Three terms are used in reference to ICT tasks: an *item* indicates the ability to perform a task, for example to cut & paste a text selection; a group of items is a *skillset* or, in analysis, a *component*, for example Word Processing is a skillset; and ICT skill(s) refer to the general grouping of items, skillsets and components.

INFORMATION: Information is a component in the process of acquiring knowledge. The activities associated with the selection, collection and evaluation of information, its efficient processing, storage and dissemination had been performed long before the advent of computers, especially personal ones (Trencheva & Denchev, 2013, p. 743). Gathering information in the digital age is easy, The World-Wide-Web provides almost infinite virtual data resources. Assuring the accuracy of information remains complex. ICT has changed the process of data collection but not the expertise and sound judgement required to produce quality materials (Fabris, 2015; Selwyn, 2010).

COMMUNICATIONS: Communications requires a minimum of two people and between any two people; cultural, experiential, historical, social and political nuances exist. Word selection is important and digital communicators have many new tools to address linguistic and cultural barriers. How these tools are used is a learned process. Again, while it is easier to communicate in the digital age it remains challenging to be an effective communicator.

TECHNOLOGY: The word technology is from the Greek *techne*, meaning 'art, skill, cunning of hand': and *logia,* meaning 'the study of' (Liddell & Scott, 1980, sec. 1). Broadly defined technology is synonymous with inventions that modify or change the individuals' relationship with their environment. Digital technology was introduced in the 1950's but online digital tools were not available until 1993, when the US federal government opened the Internet to commerce and the creation of hyper-text markup language (HTML) formed the basis for universal accessibility (Ferdinand, 2000, p. 1).

INTEGRATION: It is not easy to determine at what point an institution achieves ICT integration as it is not an exact science with a static goal. Early educators used the term 'transparent integration' as there was a need to document the procedures and outcomes of the processes. In 2003, Fluck argued that integration relates to the way in which ICT is incorporated into student learning and can, interestingly, be treated separately from its consequences. This view is validated where "integration" is achieved to the extent where it is not visible. Philosophically, full ICT integration could not be measured as 100% cannot also be 0. To integrate is to seamlessly combine components, parts or elements into a complex but harmonious whole. The notion of seamlessness is implicit in the definition that ICT integration is the degree to which ICT "vanishes into the background" of the classroom. How to detect the level of educational integration implied by the survey responses is integral to this research. This study seeks to recognize ICT integration when it is present, to be sure that ICT has not "vanished into the background" of foreign student education but is, in fact, completely missing from their educational environment.

1.2.1 Information and communications technology (ICT) as defined for this research

The term ICT must be seen as an evolution from the antecedent and more narrowly defined term IT (information technology) which maintains its usage in government, commerce and industry and in relation to tertiary and other academic courses dealing with such areas as programming, database design and expert systems (Lloyd, 2005, p. 3). ICT have two functional components: hardware and software. The *hardware* is tangible and is instructed how to act/react by *software* called applications or programs. The first software programs provided creative and efficient options for performing office-related tasks: focusing on word processing, data management and visual manipulation tasks. These software programs were installed on individual personal computers (PC) and function and performance were limited to that single PC unit. Larger companies began testing Intranet systems, private networks that could link these individual PC units and create multiple PC user groups. Developers responded and adapted programs to fit these networked environments. It was the availability of a free webserver, in the late 1990's, that would provide the next revolution in the commercial and academic computer markets. Web applications were designed to work in tandem with traditional ICT. For example: an Internet e-commerce business might use a word processing desktop application to create sales copy then use a web application, such as an online shopping cart, to interface with customers and clients. Web applications are usually made on client-server architecture and use a web-browser as the client interface (Smith, J., 2013, p. 2). This combination of ICT continued to drive commercial profitability and performance for the ICT industry. In an educational context, the importance of traditional ICT skills would continue for a time but would gradually be replaced by web applications that introduced learning options that introduced entertaining options for multimedia and multimodal exercises. However, the significance of the traditional ICT skills for higher education research and commercial sustainability could not be replaced and the Academic ICT Gap increased.

The focus of this research study are the ICT most used in support of or associated with word processing, spreadsheet, data base development, multimedia presentations, the ability to conduct research and the use of relevant hardware. The intrinsic importance of these ICT to commerce and learning dictates the variety of the ICT skills a student must master (Jaschik & Lederman, 2013). These programs and applications have set the standard for modern Western communications practices, are ubiquitous and underpin the daily processes used in global politics, academia, business and commerce (Smith, J., 2013, p. 2).

1.2.2 Research production skills as defined for this research

Complex components of educational ICT are the research production skills (RPS). They include specialized bespoke applications such as MATLAB, Statistical Package for Social Sciences (SPSS), Rhino3D, etc. As such, recognizing their educational value is important when calculating the extent of the Academic ICT Gap. For example, RPS have been a part of the foreign-language laboratory for many years. The computer-assisted language learning (CALL) research foci have typically been on enhancing input through technology, using technology to affect proficiency and achievement, providing feedback through technology and integrating technologies (Zhao, 2005, as cited in Jung, 2006, p. 4). Early CALL instructors used ICT to email, develop lesson plans and to create instructional Web pages (Egbert, Paulus & Nakamichi, 2002, p. 118). The value of ICT to CALL has grown and now influences both pedagogy and methodologies at all language-learning levels. In 2013, Chauhan, Ying and Zhenfang posited that students learning English as a foreign language come to perceive both the English language and ICT as a means to “read the world” (p. 417). Their respondents were 300 university students at university in Wuhan, China, who indicated that ICT were very important to their mastery of the English language. They believed that if a student is capable of ICT skills, it is easier to learn English on a self-regulatory basis as it pertains to their individual field of study (p. 418). ICT enables the use of a wide range of authentic materials that address student needs. Scientific-oriented materials are required to allow the development of linguistic competence and the ability to function/learn in a foreign language (Houcine, 2011, p. 2). The relevance of targeted RPS skills and knowledge is driven by a high level of technological change that results in continuous revision of what counts as both ‘basic’ and ‘advanced’ skills and knowledge in the field (Cuttance & Stokes, 2000, p. iii). For example, by identifying the general and bespoke ICT used in engineering study, students entering these areas will have the option to develop a more targeted ICT learning plans pre-commencement. RPS also have an important role in mastery of learning and content management systems (L/CMS).

1.2.3 Learning and content management systems as defined for this research

Learning management systems (LMS) are platforms that offer discrete digital spaces for courses in which teachers and students can upload or download instructional materials, create content and respond to one another's materials in blogs, wikis and discussion forums (Bakia et al, 2011). Content management systems (CMS) are online environments used to organize and manage courses, both in terms of administrative tasks and content. CMS are used to track student attendance and progress, post and share content and communicate through features such as wikis, blogs and discussion forums (Trotter, 2008, as cited in Bakia, 2011, p. 28). Across all educational levels, how ministries of education, local education authorities and schools conceive of and use LMS varies greatly by country. In most places, local or regional authorities are responsible for selecting and installing LMS, as well as for providing related training. These digital management systems are not a regular feature of P-12 learning environments in developing countries (Bakia, et al., 2011). Many students first experience them at the university level.

CMS and LMS do not require a body of new ICT skills but depend primarily on a blend of existing traditional and online ICT skills. Personal experience with social media does not provide adequate training for academic L/CMS. Fast-fingering skills create the illusion that users are adept. While manual dexterity may improve students' interface it does not improve content. Social media may prepare a student for the mechanics of L/CMS work but it cannot duplicate full immersion in L/CMS skills. Once at university, the rush to learn basic ICT skills not acquired in P-12 classrooms is exacerbated by the students' need to master RPS and L/CMS. Figure 1 illustrates the relationship of various academic ICT.

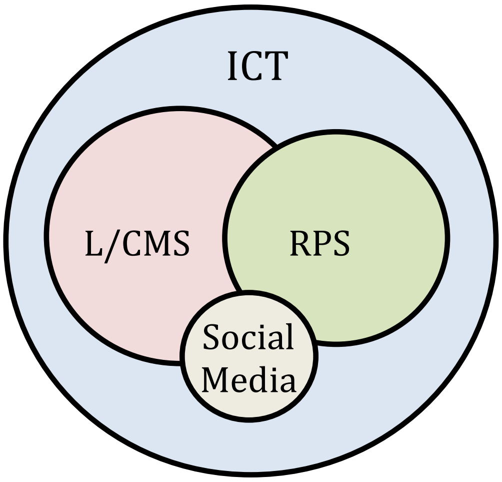

Figure 1: Academic ICT subgroups in relation to all digital media and to each other

1.2.4 Computer literacies and Bloom's Taxonomy of Cognitive Learning Levels

Similar to infrastructure innovations of the past such as railroads and the telegraph, the Internet contributes significantly to the convergence of space and time by making various types of communication- regardless of geographical proximity- quicker than ever before. The ramifications of this spatio-temporal convergence are profound and not well understood because no previous technology has embraced and allowed for as many communication services as the Internet (Hargittai, 1999, p. 702). As early as 2000, ICT required defining a new, distinctively different vocabulary and range of learning competencies or *literacies*. Competencies are distinct from traits and characteristics. Traits and characteristics are personality descriptors formed early in life or inherited. Competencies are clusters of related knowledge, skills and abilities that correlate with effective performance in a task or role at hand (Parry as cited in Parkes & Reading, 2013, p. 777) In 2000, Carvin defined the competencies of 'information literate' (the ability to discern the quality of content), 'adaptively literate' (the ability to develop new skills whilst using ICTs) and 'occupationally literate' (the ability to apply these skills in commercial, educational or domestic environments). These competencies are underpinned by levels of basic literacy in reading and writing and the functional literacy of being able to put these skills to daily use (Carvin, 2000, as cited in Selwyn, 2010). Computer education was being developed with an awareness of cognitive learning.

Bloom's Taxonomy divides cognitive learning into three levels. Functioning at Level 1 requires the ability to remember and understand learned materials; Level 2 requires the ability to apply acquired learning in a relevant context; and, Level 3 encompasses the higher cognitive functions of analysis, synthesis and evaluation of the generated results. Effective use of these ICT requires Level 1 and Level 2 cognitive learning skills (Robyler, Castine & King, 1988). When moving from Level 1 through Level 2, the ICT learning process is classic: the user is introduced to an ICT item and its function is reinforced by repeatedly applying it correctly. The learning process is complete when the user comprehends the item's primary and ancillary purposes, achieves a satisfactory item response and can apply that item response in a productive or motivational manner. This is the first step in mastering the ICT items referenced in this study. These Level 1 and Level 2 ICT items provide productive or motivational reward because they enable the user to effectively communicate their acquired critical knowledge in an appropriate academic or commercial context. The development of Level 1 and Level 2 ICT items are necessary if the user intends to effectively communicate their Level 3 cognitive learning. If the learning process is interrupted before Level 3, the user will have acquired acceptable Level 1/2 production skills. However, these production skills are intended to support the Level 3 cognitive skills. The repurposing of Level 1/2 skills is often used to transition students to Level 3 work. The Level 3 ICT-facilitated learning process supports the analysis, synthesis and evaluation processes by offering the user a range of preferential options, or learning styles, allowing them to perform a single task in an intuitive manner. For example: if the user wishes to print a document they may choose the function from the Menu Bar; they may use the CTRL-P key command; they may choose the printer icon from the header bar or have pre-set command choices. Each of these actions achieves the same result. This multi-option learning process encourages user-friendly repurposing of the available ICT and results in students mastering Level 3 cognitive learning. Today's students must master all of the ICT items that allow them to move freely between all levels of Bloom's taxonomy, combine levels when it is to their educational benefit and to apply them liberally in all facets of their university learning. They need the ability to both critically interpret the powerful images of a multimedia culture and express themselves in multiple media forms (Thoman & Jolls, 2005, p. 184). These abilities cross the range of Bloom's Taxonomy.

lists Bloom's Taxonomy of Cognitive Levels developed in 1972 (Bloom, 1972).

Table 2: Bloom's Taxonomy of Cognitive Levels of Learning

Level 1	*Knowledge*	The ability to recall learned materials. It can range from the recall of simple to complete theories. It represents the lowest level of learning outcome, requiring only that the student recall previously learned information
	Comprehension	The ability to grasp the meaning of material learned. The student may show understanding of the material by translating it from one form to another, by conveying meaning or by making summary statements about it.
Level 2	*Application*	The ability to use learned materials in new and concrete situations. The student is required to apply rules, concepts, principles, laws or theories.
Level 3	*Analysis*	The ability to break material down into its component parts so that its organizational structure may be understood. The student demonstrated attainment of objectives through the ability to identify parts, show relationships and recognize organizational principles.
	Synthesis	The ability to put parts together to form a new whole. The student demonstrated an ability to devise a new plan of operation or to produce a set of abstract relations.
	Evaluation	The ability to judge the value of materials. The student might be required to judge the value of a statement, a piece of prose, a poem, an advertisement or a research report.

1.2.5 The Genesis of the Academic ICT Gap research

The existing symbiosis between global commerce and the computer developed from a natural partnership forged over 30 years ago. The era of globalization has been characterized by the democratization of technology, democratization of finance, and democratization of information (Friedman, 1999, p. 47). I felt the full impact of the challenges of rapid corporate globalization in 1985. My first out-of-college position was Advertising Director for a desktop publisher of 18 bi-monthly consumer magazines. With a deadline every 3 days we sold, designed and positioned display and classified ads using the new (1986) Apple Macintosh Plus computer. Figure 2 shows an early generation Apple Macintosh Plus computer used in our offices.

Figure 2: Early generation Apple Macintosh Plus

This unit was transportable with a small indentation handle in the top back of the computer body. It featured a 9” monochrome monitor and 1MB RAM (random access memory). Applications and data were saved, stored and transported on 3.5” floppy disks. These were pre-Internet years but there was intranet within the publishing house. My staff of 10 women was given 6-weeks to self-teach digital office production and support skills on their new Mac+. In less time than that, they learned to organize, size type, sort copy and design small line-art advertising; to create digital databases and keep detailed records of client contacts, purchasing history, demographic information, calendar dates and to develop billing and collections systems. In the course of two years my staff mastered a wide range of desktop publishing and corporate administrative tasks, some quite complicated, and each in the manner of their specific needs. The learning curves were steep but the profitability was high and motivation to learn the new ICT was well rewarded. Similar adaptations of digital technology into corporate communities were occurring around the world simultaneously.

Desktop publishing fueled digital profitability by information access, increasing production and cutting costs. Everyone needed to *learn computers*. Not long after basic digital office production skills debuted, other applications for creating, modifying and embedding graphics, photography, sound and video were introduced. Presentation software such as PowerPoint made impressive contributions to sales and educational programs. Educators began integrating these exciting ICT into daily learning environments. Schools up-scaled to more sophisticated ICT as it became available and a preference for multimedia-enhanced education overshadowed the once-impressive basic skills. However, the ICT skills needed in today’s research-oriented universities are somewhat different to that used in general society (Haywood, et al., 2004, p. 72). They encompass all areas of student life including: production activity - engaging in an academically valued activity, such as education and/or training; political activity - engaging in some collective effort to improve or protect the social and physical environment of the university; and, social activity - engaging in significant social interaction with teaching staff and fellow learners, or identifying with academic groups, communities and cultures (Selwyn, 2010, p. 5). To fulfill these myriad educational needs, all forms of ICT, from basic to advanced, must be recognized and mastered.

1.3 Foreign students - common purpose brings uncommon challenges

It is necessary to define the terms *computer literacy* and *International* or *foreign student* and to discuss the accepted criteria of a *developing country*.

COMPUTER LITERACY: For this study, to be considered computer literate a student must have mastered a broad-spectrum of ICT to the extent that they can then build proficiency in the RPS required for rigorous university study. The nationality or native language of the student has no bearing on their ability to develop computer literacy. However, their home country or the base of their P-12 education may indicate extenuating factors that have had a strong influence on the availability and connectivity required to develop computer literacy.

FOREIGN STUDENT vs. ***INTERNATIONAL STUDENT***: In 2006, the Organization for Economic Co-operation and Development (OECD) and United Nations Educational, Scientific and Cultural Organization (UNESCO) Institute for Statistics (UIS) convention formalized the term 'International student' when referring to students crossing borders for the specific purpose of studying, and the term 'foreign student' for non-citizens enrolled at an institution of education outside their home country, but who have not necessarily crossed a border to study (therefore not strictly mobile, and cause an over-count of actual mobility figures). These two definitions are used interchangeably here as it is not within the realm of this study to determine student mobility intentions.

DEVELOPING COUNTRY: UNESCO designation as a developing country indicates that a disproportionate percent of the indigenous population subsists below the poverty line established for that country. By that definition, the People’s Republic of China and India, both with robust economic growth, remain developing countries (World Bank, 2015).

Table 3 provides Australian Bureau of Statistics data from 2013 that indicates the home countries of Australian foreign students across all levels of education. Of these ten countries, eight are defined as developing countries by UNESCO and the International Monetary Fund (IMF). The status of these eight developing countries and other regional players, such as Singapore and Hong Kong, will be considered in this literature review. In Table 3 developing countries are displayed in RED.

Table 3: Australia's foreign student populations' origins: current and future.

Current Student Enrolments		Student Enrolment Growth Countries	
People's Republic of China	28.9%	Philippines	+26.3%
India	9.2%	Colombia	+19.4%
Republic of South Korea	5.2%	Pakistan	+17.6%
Vietnam	4.9%	Brazil	+16.3%
Malaysia	4.1%	Taiwan	+12.6%

Similar configurations of International students from developing countries were enrolled in Canada, New Zealand, the UK and US.

- In 2013, Canada enrolled 246,530 International students in post-secondary schools. Over 43% (126,825) were from China (32%) and India (11%). An additional 13 countries were above 1% of the total and together they accounted for an additional 33% (97,585) of the total number of students. Of the top 15 countries, 8 were designated UNESCO developing countries (Deacon, 2015).
- In 2013, New Zealand enrolled 75,420 International students in post-secondary schools. Over 50% (38,010) were from China (32%) and India (18%). An additional 25 countries were above 1% of the total and together they accounted for the remaining 50% (37,410). Of these 27 countries, 14 were designated UNESCO developing countries (Engler, 2015).
- In 2013, the UK enrolled 435,495 International students in post-secondary schools. Over 24% (106,176) were from China (19%) and India (5%). An additional 18 countries were above 1% of the total and together they accounted for an additional 42% (183,275) of the total number of students. Of the top 20 countries, 7 were designated UNESCO developing countries (UK Council for International Student Affairs, 2015).
- In 2013, the United States of America (USA) enrolled 819,644 International students in post-secondary schools. Over 40% (332,351) were from China (29%) and India (12%). Thirteen other countries accounted for an additional 45% (370,132) of the total number of students. Of the top 15 countries, 4 were designated UNESCO developing countries (Institute of International Education-IIE, 2015).

Canada has a long history of welcoming Asian populations, having established political relations with the Peoples' Republic of China (PRC) in the 1950's, over 20 years earlier than other Western governments. Its foreign student enrollment numbers are similar to those of New Zealand and Australia as are the number of UNESCO developing countries on their rolls.

The UK had the lowest percentage of Chinese/Indian students who accounted for only 24% of the

2013 student total. The UK statistics listed a large European Union student population possibly because these students receive monetary consideration from UK schools. This compilation of countries gave the UK a much lower representation of UNESCO developing countries not all of which were Asian.

In the USA the Chinese/Indian cohort represented 40% of their total foreign enrolment. Again, the foreign student body represented only 4 UNESCO developing countries. The USA attracted students from most of the developed world in substantial numbers. Many of the UNESCO designates sent far fewer students and, while they were represented, their figures were not large enough to rank above 1%. Lower percentages of Asian foreign students in the USA and UK may allow institutions in those countries to minimize the effects of the Academic ICT Gap.

Foreign students who choose to study abroad have a common purpose: to earn a degree or certification that will advance their future. The high investment in education not only increases the economic burden on parents but also doubly burdens children academically and psychologically. "High input is often accompanied by high expectations, and high expectations require high investment for guarantee" (Xi, 2013). Many foreign students will measure the overall success of their higher education by the eventual relocation of their family to their host country. Preparing for study abroad is all-consuming. Foreign families invest years in preparation; in language classes, science and mathematics study, and, visits to schools, testing, paying fees and applications.

The Asian student's choice of host country and receiving institution is a complicated, highly considered decision. Parent and child are heavily influenced by the Confucian tradition (Spring, 2012, p.145). Parents often control decisions as an extension of their plan for the family's economic position and future. Their institutional choices are confusing and seem endless yet they are discovering they have *purchasing power* (Bodycott & Lai, 2012, p. 252).

Chinese parents have displayed a high level of academic purchasing power. They account for the largest bloc of foreign student enrolled in any Western institution. UNESCO has designation the PRC as a developing country. Given this designation and considering the number of PRC students attending Western institutions, PRC students were chosen to serve as a cohort-prototype of all foreign students for this study.

1.3.1 Assimilation and governmental challenges

Many national and domestic groups and policies affect the success or failure of foreign student recruitment efforts. Administrative issues such as visas, residence and work permits are also a concern for Chinese students, putting some countries, such as the European Union (EU), at a disadvantage with countries such as Australia. Economic fluctuations have also led certain EU Member States to tighten regulations to prevent economic migration. In addition, cases of Chinese students unable to enroll in any institution at the end of preparatory language courses in their host country revealed the need for a review of the pre-registration and admission system and for additional support services (Mathou & Yan, 2012 p. 295). The lack of support for Chinese students, before and during their mobility period, is a concern, especially in countries where comprehensive campuses and student halls of residence are not common. Without easily available inclusion opportunities, foreign students create campus groups that represent their native country and bond with the group members: in essence they never leave home. In line with Confucian views of family, PRC parents and often extended family are prepared to commit extensive amounts of money and family involvement to their child who is studying abroad, and the risks that these students and their families face when undertaking such ventures are of vital concern (Bodycott & Lai, 2012, p. 252). The promise or desire to emigrate is a major factor in PRC parent decision making when it comes to the choice of study abroad (Bodycott, 2009, p. 353).

1.3.2 Educational challenges

Computer technology was first introduced to the public in the 1970’s, by military and governmental bodies in collaboration with Western higher education for use, primarily, in the academic fields of science, technology, engineering and mathematics (STEM). From there it migrated into the P-12 grades. According to many sources including UNESCO, Western developed countries had attained an acceptable level of ICT integration across all public education by 2000. But what of the students and the schools in non-English speaking, developing nations? We should anticipate that the foreign students’ preparatory education would be very different from their Western counterpart. With the increase in non-English speaking foreign students, many from developing counties, investigating, monitoring and managing the Academic ICT Gap should be a continuing assimilation issue.

In both domestic and international-prep schools, China has the most expensive school system in the world with parents paying up to 60% of their annual income to educate their one child (Economist, 2014). Teaching methodology basically consists of force-feeding copious amounts of required information directly out of textbooks (often teachers will simply read directly from the text) and students are discouraged from asking questions, particularly if those questions challenge ideology or anything regarded as factual. Teachers receive bonuses for their students' performance on these exams (Mavrides & Hayes, 2012, p. 3). Classroom size tends to vary between 40 to 60 students and, theoretically, no more than 35 students for English language classes.

The Academic ICT Gap

PRC students preparing for study abroad remove themselves from the domestic school system in grade 9 and for the next 4 years invest six-days-per-week in specialized language courses and training to pass the International English Language Testing System (IELTS) or Test of English as a Foreign Language (TOEFL) English language tests as well as other mandatory college entrance exams. Students and parents remain focused on the traditional English-language skills needed for higher education to the exclusion of all other skills. To this end, many PRC students live in boarding schools and when feasible return home for 36 hours over weekends (Mavrides & Hayes, 2012). They are not allowed computers at school because of security issues. They do not have wireless connectivity because it is unavailable in most areas, and their mobile phone use is limited to after hours, between 8-10pm, before they retire. Their daily schedule is unvarying and based on rote, repetitive learning (Min, 2013). The traditional rote learning, teacher-centered system continues to prevail in the majority of Chinese institutions which is often counterproductive to the efforts to encourage critical thinking and creativity (Ivanov, 2013, p. 2). In more recent years, China, like so many other countries have begun teaching to the tests, in this case the English-language tests required for students to gain university acceptance in countries other than China (Yan S., 2012).

Dependence on rote-learning is ironic. If a student is capable of ICT skill, he/she can learn English on a self-regulatory basis (Chauhan, Ying & Zhenfang, 2013, p. 417). However, guidelines as to what ICT items a university-bound 2nd language learner must prepare for do not exist. A new expanded conceptual framework as to what kind of foreign language literacy students should acquire is needed. That framework would reflect the role of ICT in social, cultural, political and economic transformation, which in turn has a real impact on changes in the characteristics of foreign language literacy in the 21st century (Chauhan, Ying & Zhenfang, 2013, p. 411). The results of this research will provide the first Academic ICT Baseline of the ICT required by Western universities.

In 2016, the PRC will eliminate the English-language portion of the Chinese university entrance exam, or *gaokao*, that every domestic student must take to determine their university placement options. The *gaokao* was eliminated during the Cultural Revolution but reinstated in 1977 with English accorded the same status as Chinese and mathematics. According to the Jiangsu Province Ministry of Education (CMoE), learning English has become “too much of a good thing” with English language education and training becoming institutionalized, forcing Chinese students to learn by rote for the sole purpose of passing various exams (Global Times, 2013). This will change the need for domestic P-12 schools to focus on teaching English and instead allow more time for STEM-related instruction. The impact of this dramatic policy change on the English language abilities of the foreign student enrolling at the university level is not yet evident.

1.4 International schools and teachers - common denominator

The important common denominator between International schools and P-12 teachers is the English language: the teaching of it and the growing demand for learning it. The need for English-language teachers, preferably native speakers but certainly fluent speakers, is on the increase. Such a strong demand makes the transition from domestic to international teaching attractive to many educators. Conducting an ICT skills survey of commencing foreign students was impractical for this study. However, conducting an online survey of their university-trained teachers was an option. In this instance, second-hand data gathering was an acceptable alternative to surveying the source: the foreign students. Nowadays International schools increasingly belie their name. Though their clientele varies from place to place, four-fifths of the pupils they teach around the world are locals (Economist, 2014). Observational input from International school teachers would be used to develop the prototype of an Asian P-12 classroom. My first-hand teaching experience in P-12 classrooms in Asia guided my research. I required a random sampling of teacher testimony representing different international contexts upon which to build an arguable thesis based on a broad range of students.

1.4.1 The International teacher

A domestic teacher becomes an International teacher simply by accepting a teaching position at an International school. In 2000, there were just over 2,500 recognized International schools which provided instruction in English. Their coursework is based on the Western curriculum as taught in Australia, Canada, New Zealand, the UK or the USA. In 2014, the International College of Economics and Finance (ICEF) Monitor recognized over 7,324 International schools that offered English-only curriculum. The number of non-recognized schools that simply assume the title *international* continues to grow, making it impossible to calculate the number of teachers working in International or non-domestic P-12 schools around the world. For example: in 2009 UNESCO Institute for Statistics estimated that between 2007 and 2015, 10.3 million teachers would need to be recruited to meet universal primary education goals (Bruneforth, Gagnon & Wallet, 2009, p. 1). Schools developers are expected to continue expanding their institutions and opening new schools to meet the growing demand. But while new school buildings are easily erected, there is one essential ingredient that is considerably more difficult to produce – quality educators to fill these schools. “The greatest challenge will be the recruitment of top quality teachers” (Maxwell, 2015, para. 19).

These growth figures indicate that International school teachers may be the largest unrepresented, uncounted, ungoverned migrant work force in the world. They are defined not by their *internationalness* but by their profession: *teacher.* There is no standardization to International teacher certification. Professional certification is earned in their native country where they are trained, tested, approved and confirmed by universities, school boards or other academic institutions. International schools hire teachers based on their national accreditation. The designate *International teacher* is assumed simply by accepting a teaching position at an International school location.

1.4.2 The International school

There are many types of alternative education providers, from store-front, for-profit English language shops to well-established full-curriculum International schools. In 2014, the ICEF Monitor recognized over 7,000 International schools whose sole offering was English-language curriculum. These are the more reputable schools, marketing themselves as tier-1 and tier-2 schools. Many of these schools have diversified and now offer a range of national curriculums such Japanese, Korean, German and Chinese on the same campus as they address the needs of growing expat enrolments. Because staffing is challenging, International teacher recruitment agencies have developed but are difficult to monitor. Search Associates, the largest for-profit recruitment agency, recognizes and represents over 3,000 International schools. The Council of International Schools (CIS) is a global non-profit organization established in 2003 that certifies school curriculum and teaching standards as well as providing teacher placement services. CIS recognizes less than 700 schools as being truly *international* (CIS, 2015). These recognized schools have the highest teacher certification requirements; hiring those with university degrees, national certification and teaching experience. Teachers with lesser qualifications, such as single certification in Teaching English as a Foreign Language (TEFL), are accepted in developing countries' domestic schools, where all other instruction is in the vernacular and the Western teacher is often the only non-native on staff. TEFL and similar certifications are also accepted by myriad commercial entities providing sub-contract services to domestic schools that do not provide in-house English-language instruction. There is limited governance and oversight of the for-profit providers. In international education *caveat emptor* is the rule. Students completing their English-language education in the less recognized schools and training centers may be expected to have very limited ICT skills.

1.5 Western universities - common interests

To define a Western university prototype this study examined a range of academic, societal, commercial and political commonalities. "When people make money, they want their children to learn English. When they make more money, they want them to learn in English" (Economist, 2014). The structure and composition of Western higher education stems from liberal arts traditions inherited from the Greeks and Romans: the same source as their common English language.

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Common heritage is both an asset and a detriment in International student recruiting. All Western English-based universities, by association, are considered to have superior academic programs even though this supposition is based only on their common language and not on the quality of their end product. Academic analysts annually track student mobility trends within the Main English-Speaking Destination Countries (MESDC) which include Australia, Canada, New Zealand, the UK and the USA. The MESDC countries are forecast to increase annual foreign student enrolments but an increasingly a slower pace (Kevat, 2013, p. 7). Analyses consider factors such as student perceptions of quality of education; employment prospects; affordability; personal security; lifestyle, and, educational accessibility: factors not within the realm of institutional relevance. These factors can be manipulated to some extent by academically-sensitive government policies but may bring unpredictable results. The internationalization of education has brought together students, parents, teachers, administrators, commerce and industry in ways barely imagined pre-technology. And, each group must be considered when constructing a global future for education (Global Education Futures Forum, 2015).

1.5.1 Academic consumerism and the promise of a future

The students-as-consumer metaphor became popular c. 1990, when the best-business-practice of Total Quality Management (TQM) was first applied to higher education. Student services TQM programs were deemed successful if they increased student retention. In an attempt to mimic business practices, educational systems adapted to perceptions that were not always sound. While "the customer is always right" may provide immediate gratification it is often at the expense of the students' own long-term best interest. It became an issue of addressing *wants* or *needs* or both. Needs satisfaction was oriented toward baseline performance, providing students with what they cannot do without. Fulfilment of wants, on the other hand, guided educational practice to best case scenarios. "Need satisfaction often has taken the form of emphasizing basic skills that students might not *want* to stress despite their later recognition of *needing* these skills" (Schwartzman, 1995, p. 21). Since 1995, academic recruitment efforts have been refocused on the foreign, primarily Asian, students. This change of market adds new dimensions to the wants versus needs conundrum as universities indicate that many of their foreign students' needs were not anticipated by their traditional business models. Foreign students expect their Western universities to provide support and solutions for a range of needs and wants that they believe constitute a TQM education.

Foreign students are becoming savvy consumers and once sacrosanct areas are no longer assured.

1. Instead of coming West immediately, Asian students are showing a growing preference for

undergraduate study closer to home. This option is often more affordable and allows the student to delay their Western educations for more career-oriented post-graduate study Fischer, 2014).

2. As globalization influences business mobility, non-English speaking curriculum is becoming more popular with some foreign student blocks. In 2012, Germany and France together account for almost 20% of the foreign student population (Kevat, 2013, p. 5). This may be due to German and French economic investment in foreign countries. However, Asian 2nd language learners may see similarities in the Romance and other Latin-alphabet languages that Westerners do not that allow them to add languages beneficial to future career choices.
3. Foreign degrees, once considered a benefit in the home job market might now become a disadvantage (Fischer, 2014). Returning students have not built up the local connections nor do they have regional and national career placement services at home.
4. Options to remain in the host country and work after completing a degree are not always assured. Entering into a foreign program at the Master or Doctorate level provides better long-term assurances of family relocation (Fischer, 2014).
5. Some Asian universities are now opening branches in other countries so that native students can venture to a foreign country and still retain their home connections. Suzhou University based in Jiangsu Province recently opened a campus in Laos, a symbol of China's growing international ambitions and drive to export its economic development model (Ivanov, 2013).

In an attempt to keep more students at home, foreign institution are learning from their Western partners and rapidly adapting. Such collaborations provide a practical and efficient way to improve the quality and standard of mainland universities. They facilitate Chinese university management understanding of 'current educational missions, ideas, curriculum management and delivery of educational programs' (Huang, 2005, p. 45). Other Asian universities are entering the global market by pairing with Western institutions. Strategic alliances, institutional consortiums, regional co-operation agreements and staff and student mobility programs in the field of higher education are today common features of internationalization policy and practice (Bodycott, 2009, p. 352). Malaysia has developed an aggressive 'twinning program' that pairs Eastern and Western study at almost every one of its national institutions. This option can be attractive to the Asian parent as it can be customized to fit the student's needs. Singapore universities offer higher education at 50% tuition if the student agrees to remain in Singapore and work for 2 years after graduation. If the student reneges on the work contract then they must pay the full tuition before graduation. This is an attractive option for cost conscious Asian students who also wish to either relocate permanently or at least gain important international work experience after graduation.

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Western universities, increasingly dependent on foreign student revenues, court the foreign parents with the tacit agreement that upon graduation their child will be an equal to the Western graduate and capable of taking up a role in the global marketplace (Humphreys, 2013, p. 1). Vague, implied marketing strategies certainly do not constitute a legal document for an institution. But for the foreign student/parent, the recruitment process is a multi-faceted agreement pregnant with implied mutual responsibilities. In exchange for these assurances, the foreign parent funds their child's Western education.

In a 2014 interview with The Telegraph newspaper, Lord David Puttnam, Labour Peer and Chancellor of the Open University, coined the term "natural conservatism" to define the reluctance of higher education institutions governance bodies that are "holding back changes" that would enhance ICT in education. He supports encouraging "visionary teachers who can use the resources and are not intimidated by them" (Gurney-Read, 2014). While they may not feel particularly *visionary* the classroom educator has continually stepped forward, over the past thirty years, as the primary ICT innovator and integrator. By default, it is the classroom instructor's choice of ICT that most effects digital curriculum delivery and student learning. The beliefs and values of the individual academic significantly affect how the curriculum is developed (McGowan & Potter, 2008, p. 187). Educators accept the unpredictability of ICT and survey data indicates they make creative use of this chaos. It seems administrators count on instructors accepting increased workloads. We have consolidated out purchasing power and aggressively negotiated contracts in areas from dining services to benefits to information technology. In this period of cost savings, we are also leaning heavily on our talented staff members to do more with less without compromising their high standard of performance" (Fliegler, 2013, p. 2).

Decision-makers expressed that they lack data when planning unorthodox financial and marketing strategies. Instead they hold to traditional measures that focus on balancing the budget by the hiring and firing of faculty members based on market needs; the recruiting of students for profits; the creating of quick programs to maximize economic gains; the judging of professors' teaching performance according to consumers' demands; the standardization of curriculum, instruction and assessment for economic efficiency (Porfilio & Yu, 2006, p. 225). Ninety-two percent of university chief financial officers (CFOs) in the US are adding the retention of student already enrolled as an important facet of their financial planning (Lederman, 2013, p.2) Administrators admit that *how to implement* a mutually beneficial agreement lacks economic precedence and clear data. It is a "*work-in-progress*" and that often they are woefully unaware of their campus' grass-roots essentials (AGBUC, 2013, p. 3). In such cases, they would better benefit by developing growth plans based directly on the expressed needs of the students and classroom educators, the two groups who are, too consistently, the last to be consulted in the decision-making process (Jones, 2013, p. 97).

As the global higher education market changes, traditional Western universities must find ways to secure their market share. Unfortunately, Western institutions are not known for flexibility and making rapid changes to their business models (AGBUC, 2013, p. 2). Western universities also must find ways to market their unique qualities without degrading their competition: other universities. Institutional marketing is a highly prescribed field. Western universities compete for students using foreign subsidiaries and off-shore representatives who can conduct recruitment in the student's native language.

The ability to digitally research, compose and communicate in English is fundamental to both academics and business (Australian Bureau of Statistics-ABS, 2013, p. 1). However, increasing the institutional market share is not the focus of this study. At the heart of this research is preserving the relationship between the student and the university instructor who, in the name of their institution, accepts educational responsibility.

1.5.2 Academia and commercial interests find common cause

Advancing the global economy and achieving societal goals requires higher education to produce graduates who have been trained to think analytically, creatively, and practically. One of the main goals of foreign language teaching in higher education is to develop students' foreign language communicative competence in all its manifold components (linguistic, sociolinguistic, discourse, sociocultural, strategic), needed for students to communicate in social and professional areas. The use of ICT in foreign language learning focuses on the development of verbal skills (reading, speaking, writing, listening), language skills (vocabulary, phonetics, grammar) and the formation of socio-cultural and intercultural competences (Sysoyev & Evstigneev, 2014, p. 85). Highly valued are skills in information technology, negotiation, teamwork, creativity and leadership. The interests of commerce and academia converge when confronting how to develop models that best incorporate ICT with the goal of producing a literate, globally capable workforce. Two considerations must merge and be balanced in order to create capable, trained graduates.

1. The institutional aspects of internationalization, perceived to enhance quality, offer an economic benefit or elevate perceptions of the institutions and its reputation.
2. The benefits for students of an internationalized education which includes student support, inclusive pedagogy and questions of curriculum at home or overseas (Jones, 2013, p. 96).

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In order to develop business-relevant courses, educators must design curriculum with an increased emphasis on the students' ability to link the content with the *real world*. A lack of educators with private-sector business experience is often cited as a primary reason that classroom curriculum falls short of real world application (Oblinger & Verville, 1998). The instructor is primarily responsible for how ICT is used to support their curriculum and as such they have the power to raise or lower the level of instruction. Indications are that ICT are only used when there is a perceived direct benefit. Educators are acutely aware that development, planning and integration of ICT into all areas of their curriculum strains their time and their patience (Bertram & Waldrip, 2013, p. 2; Pellicone, 2001, p. 2; Usluel, Askar & Bas, 2008, p. 263; and Waycott, Bennett, Kennedy, Dalgarno & Gray, 2010, p. 1203). One study suggested that with advanced technology, cognizance has not been taken of the demands placed on the faculty members, who as academicians are increasingly involved in administrative tasks, rather than the core business of teaching and learning, community engagement and research (Moodly & Adu, 2014, p. 202). For budgetary reasons, universities are increasing their dependence on temporary or 'sessional' staff. These teachers may lack the motivation to invest time and effort into best-practices, a problem that seems acceptable to universities who don't provide high levels of support for these instructors. This is a modern oversight. Professional educators with real world experience are the missing component to creating a curriculum that mirrors the post-graduate experience both for colleagues and students.

1.6 Assessment and remediation for all academic stakeholders

The Digital ICT Gap includes the ICT skills that are ubiquitous in all areas of education and commerce and that must be mastered by stakeholders at every level of government, commerce and education. But within the Digital ICT Gap are subgroups of skillsets. When specifically applied to the education cohort, the Digital ICT Gap narrows and becomes the Academic ICT Gap. The Academic ICT Gap is defined as the ICT skills discrepancy between the commencing students and Western higher education. In order to identify the nature and extent of this Gap requires designing a unique survey, collecting data from two diverse cohorts and comparing their responses.

Students are required to interface with ICT to perform most academic and administrative tasks. Universities provide incoming students with remedial ICT assistance and support but to effect systemic changes they must analyze the scope of the Academic ICT Gap. RPS may be taught as part of a higher-order course but the student is assumed to have the basic ICT that underpin RPS. Without administrative intervention, the burden of developing both basic ICT and RPS falls to the individual educators who daily bridge the Academic ICT Gap. Universities are not remedial institutions and the role of the classroom instructor is not to assess skill levels and provide ICT training. The tertiary instructors' focus should be on stabilizing current ICT, integrating ICT into L/CMS delivery and identifying emerging ICT to enhance advanced research efforts. University instructors, in order to perform the adoptive tasks of remediating student ICT skills, must also maintain their own high level of ICT skills and in conjunction with time management, balance their own ICT learning commitment with the need to maintain curriculum standards. This creates undue pressures on the learning environment. The trend to gauge instructor effectiveness by asking student opinions clouds this argument. Again we are looking at an interpretation of wants versus needs. Attempts to develop higher order skills requiring deep learning approaches among Chinese learners who are not proficient in English is likely to result in negative evaluations because these students complain that the tasks are "too difficult". Consequently, we raise the possibility that academics may be hegemonically influenced to accommodate Chinese learners preferences by "dumbing down" content in circumstances where the over-dependence on their fees has resulted in the enrolment of students with a poor command of the English Language (McGowan & Potter, 2008, p. 191).

University administrators may allow their personal ICT skills to wane once they leave active teaching. They may have support staff perform the more complicated ICT duties. This does not absolve them from the expectation that they continue to be challenged, as are their faculty and students, by continual upgrades in ICT skills. Professional development programs that align ICT standards for administrators, educators and students were proposed by the International Society for Computers in Education (ISTE) in 2000. At that time, "What [was] most significant about ICT is the increasing convergence of computer-based, multimedia and communications technologies and the rapid rate of change that characterizes both the technologies and their use" (Toomey, 2001, para. 3 as cited in Lloyd, 2005). Administrators may be better able to make informed decision about campus ICT allocations and use if they have aligned their skills with their instructors' and students' skills. "It's not that higher education started doing a lousy job, It's that what was being asked of them was much more strenuous than it had been before" (Fabris, 2015, p. 4)

The commercial sector has a vested interest and a growing role in the development, support and transference of academic ICT skills from the classroom to the office. In developing countries, 3rd-party support for ICT in education has been slow to garner. But in the West these 3rd-parties have been a considerable force in directing state institutions' decisions. The need to develop transferable technology skills is redefining the relationship between the commercial and education sectors. Students formerly could acquire employable skills in the workplace. But less of that is happening now and, at the same time, new hires are expected to know more. Few jobs currently exist that do not require basic computer technology skills. Academic decision-makers are reluctant to speculate about the quality of the next generation workforce. Even the students are not sure about the caliber of their work readiness. When surveyed, students indicated that they felt qualified in areas like written and oral communication, critical and analytical thinking and applying knowledge and skills to the real world. But employers consistently rated students lower than they rated themselves (Fabris, 2015, p. 4). The National Board of Professional Teaching Standards reports that students must be prepared for a changing job market as most people currently employed are working in jobs that did not exist when they were born. Students must be trained for work within companies that locate different parts of their production, research and marketing in different countries, but still tie them together through computers and teleconferencing as though they were in one place (Friedman, 1999).

Sub-standard ICT skills negatively affect a much broader spectrum of stakeholders than just the incoming student and correcting the problem is not the purview of any one group but requires a concerted effort on various fronts. The actual decision-makers are limited in number yet powerful in their ability to affect change. This study is significant because it demystifies the ICT integration process by: suggesting a simplification of the definition of the ICT skills required, defining a curricular segregation of manual ICT skills and cognitive RPS; and, providing quantitative data upon which a whole-school ICT integration action can confidently be based. Such “next-generation alignment” requires that governments generate partnerships with universities, philanthropic foundations, teacher and parent associations and businesses (Laferriere et al., 2015, p. 2). By closing the Academic ICT Gap every stakeholder group could expect a positive return on their investment. Basic ICT are entrenched in the global economy and higher education yet students and instructors remain inadequately prepared to deal with the rapid growth of ICT in daily education. Third-party organizations (e.g., foundations) that want to make a contribution (money, time and energy) toward digital equity processes are encouraged to produce policy guidelines that target sustainable innovation in settings of their choosing (Laferriere et al., 2015, p. 2).

By reviewing data from a range of eclectic resources this study considers:

1. the commonalities shared by academic, social, commercial and political concerns;
2. their collective expectation that Western higher education produce a digitally-capable workforce; and,
3. the substantial influence in the educational policies and processes of developing countries most notably in Asia that these collective forces exert.

The Academic ICT Gap

There are generational differences in these cohorts, as noted by Prensky (2001) that may inadvertently retard the integration process. Parents, teachers, senior administrators, supervisors and managers may be Digital Immigrants born before ICT was entrenched in education (Zur & Zur, 2011, p. 9). But unlike Prensky this researcher posits that the Digital Immigrants actually underestimate the academic value of their personal ICT skills. Instead many become self-appointed Luddites and miss sharing their valuable ICT skills with colleagues and students. Digital immigrant administrators may take the basic ICT skills they learned in their early years for granted. This devaluation of their academic skills prevents them from recognizing the performance problems of the digital native students and instructors who missed those early computer years. Administrators also indicate that they lack the definitive data from their campus faculties that would help develop solutions. Without this close affinity and divided by age, they may choose short-term panacea over long-term solutions. Research suggests a considered approach, advocating caution to all those arguing that universities and academic staff have to continually change to accommodate the Net generation. The new generation of students shows significant age-related differences but the generation is not homogenous nor is it articulating a single clear set of demands (Jones, Ramanau, Cross & Healing-UK, 2010, p. 731).

Experience has its dictates and digital immigrants need only to reflect on their ICT learning and apply that experience to the current generation. At one time educators could imagine seamlessly integrating ICT items into the educational fabric. Basic ICT, when compared with the vastness of modern multimedia, is a manageable commodity. They are integral to every aspect of the learning process: developing foreign language skills; collecting data used in critical thinking; organizing and storing references for research; analyzing and calculating figures; producing presentations; providing multimedia; and, preparing data and information for dissemination. This is the level of ICT integration that developing countries could easily set as their first goal on the road to full inclusion of ICT integration.

In 2013-2014, an online survey of 12 Australian university systems, representing the global *haves* of higher education, generated 353 viable returns from university educators who ranked the importance of 65 common ICT items in order of their importance to university coursework. From these data the Academic ICT Baseline was created providing an ordering by importance of the ICT items a student should master before entering Western higher education. (See Appendix 1: *What do Australian universities want in student ICT Skills?* For a more detailed presentation regarding these 65 items). Of these 65 items, 28 of the most common items were selected for this comparison study. (See Appendix 2: *SurveyP-12* and *SurveyHE* Question Bank) A second online survey generated 134 responses from International teachers at primary through secondary (P-12) schools not located in foreign, primarily developing countries. For this research the two surveys will be referred to as the Survey of Higher Education (*SurveyHE*) and the Survey of Primary through Secondary Teachers (*SurveyP-12*). The suitability of each of these groups to represent their distinct yet related cohorts is a unique aspect of this study.

Australian *SurveyHE* respondents represent the Western cohort. Historically, Western academic ICT integration developed along similar timelines in the USA, Canada, New Zealand and the United Kingdom (UK) making the *SurveyHE* responses indicative of other Western institutions. Unique to this survey is that university educators, initiators of ICT learning, were directly allowed to share their decision-making preferences. Elspeth Jones (2013) in analyzing the academic decision-making process noted that in most instances the academic staff is rarely the focus of inquiry (p. 97). She considered this lapse a primary flaw in the efficacy of internationalization of education efforts. This thesis study balances the input and needs of the university instructor, the academic administrator and other decision-makers with those of the International students and recommends comprehensive assessment and remediation programs that integrate the interest of all stakeholders.

1.7 Chapter summary

ICT mastery is integral to the student's success in higher education at a Western, English-speaking institution. It is the student's primary tool for communicating their acquired knowledge in a recognized academic context. ICT is comprised of three related concept-words: Information, Communications and Technology. Gathering information is a solitary effort. A person seeks information from a preferred source, internalizes the data collected and choses how or if to act upon it. No second person need be involved in the collection of information. Communication, however, requires more than one person to complete the informational-exchange cycle. Communication can be achieved using words, pictures, sounds, etc. The range of available communication media has grown exponentially since the advent of the World Wide Web. Computers were invented in the Western, developed countries. This established English as the lingua-franca of early digital technology. English language learning has been heavily influenced by the language translation applications, multimedia and multi-modal technologies that have expanded the user's knowledge attainment options. In addition to written and spoken words, multi-lingual information and communication is conducted using imagery, iconography and audio prompts. For the foreign student these multimedia options can both supplement and enhance their understanding of the English language. The successful pairing of English language learning and digital technology was one of the first areas explored by early computer educators and has continued to be a rewarding learning experience for those who take advantage of the range of ICT available in English-language learning. Mastery of ICT allows the non-native English speaker to better communicate their acquired knowledge in an academic context.

This study established the importance of ICT integration in pre-tertiary education. At university, all students need academic-level ICT skills in order to successfully participate in day-to-day learning. This level of ICT integration is not currently part of the pre-tertiary curriculum in many developing countries. The absence of sustainable classroom-based innovation with digital technology is a reality in both developed and developing countries. It may be that digital tools and resources are underused given the pressures of curricular demands in developed countries (Cuban, 2015). Hence, we have a growing number of unprepared students are entering higher education under the allusion that they are sufficiently prepared to compete at that level.

Western universities have no direct influence over the P-12 curriculum in foreign, developing countries. Yet, Western universities can reinforce the importance of integrating basic ICT into education by providing an Academic ICT Baseline of the ICT skills students must master before entering higher education. Taking the lead in defining the level of rigor in P-12 ICT education would benefit students, parents, instructors, administrators, business and other supporting stakeholders. Two options are obvious:

1. Universities can continue down the path of becoming remedial institutions, watching instructors *dumb-down* coursework and unable to produce a trained workforce in the numbers and with the abilities needed by commercially.
2. Universities can disseminate an Academic ICT Baseline that aggressively identifies the ICT and RPS skills commensurate with every level of study and incorporate programs that address these needs alleviating everyone in the chain of higher education instruction of the responsibility of remedial ICT training and assuring a graduate workforce commensurate with their enrolment expectations.

The second option should be the preferential option for progressive stakeholders. To achieve this goal, the existence and extent of the Academic ICT Gap must be identified and the Academic ICT Baseline applied at the P-12 educational levels.

2 HISTORICAL CONTEXT

Context: *The parts of something written or spoken that immediately precede and follow a word or passage and clarify its meaning* (Oxford Online Dictionary, 2016)

The word *context* stems from Late Middle English and is derived from the Latin *contextus*: *con-* 'together' + *texere 'to* weave'. Beginning this chapter by weaving together the historical context with current finding provides a didactic argument for this timely research and its impact on current educational providers and their students. In the absence of related research the historical context supports logical assumptions made relative to the research topic.

Understanding how the computer and related technology developed is important chronology. The origin of the Academic ICT Gap was the mid-21st century Digital Divide. Once established in the private sector, applying computer technology to education was a logical step and an important investment for business and governments. For the four decades from 1970 to post-2000, an overview of how governments and politicians supported ICT integration will be examined in the general context of the effect on both P-12 and higher education. When possible, the literature will be from the referenced time period. For example, when discussing events of the 1970's resources from that period will serve as testimony. This is an attempt to eliminate observations either sharpened or clouded by hindsight. The resulting panorama indicates that existing literature and subsequent bodies of research have not only predicted an Academic ICT Gap but have continually sounded alarms that have been consistently ignored.

2.1 The world and computers

In the period between 1945 and 1980, American military, government and corporate interests were struggling to keep up with the post-war industrialist investment in technology. America wanted colder refrigerators, warmer houses, dishwashers, televisions, etc. This was a period of cold war, hot buttons and secret bombs. It was not a time to share discoveries until they could be neutralized. A few technologies slipped through the cracks and International Business Machines (IBM), for one, would undoubtedly regret patents freely given to Microsoft. All of these events simply added intrigue to an otherwise benign and simple invention: the computer. "The sole purpose of every computer program in the world is to contain numbers and display them to a human" (Griffith, 2010, p. 64). (See Appendix 3: Timeline of ICT Developments East and West by Generations)

2.1.1 Pre-1970

In 1944, library/information expansion was calculated by Fremont Rider as doubling in capacity every sixteen years. Rider's seminal work, *The Scholar and The Future of the Research Library* warned that there was an increasing shortage of space in research libraries and described his own invention, the *microcard,* precursor to the computer data punch card and inspired by then-recent advances in micro-text by the Readex Microprint Corporation (Rider, 1944, p. 306). At this time, the US Department of Defense (DOD) Ordinance Corps was spearheading research into the initial development of the first computer which was proposed in 1942 and completed in 1946. The Electronic Numerical Integrator and Computer (ENIAC) was installed in the Ballistic Research Laboratory at Aberdeen Proving Ground, Maryland, in 1947. In 1961, Karl Kemph, then historical officer at the proving ground, believed the details of those first years would be important and sanctioned a history of the early evolution of the computer for military and government use. Even in 1961, the impact of the computer was indeterminate. "It must be left for the historian of the future to accurately evaluate the effect of automatic computing machines on man's destiny. It is yet too early to make even a good guess. However, one thing is certain: electronic computers have ushered in a change equal to that of the Industrial Revolution" (p. 3). Kemph's comparison of the Digital Age with the Industrial Revolution was prophetic of the economic and social changes it would bring. The computer not only *spoke English* it spoke *American English*. The relationship between corporate America and the US military or DOD was strengthened by the new computing machine and this directly reinforced the growing illusion of American global superiority. It was the adoption of computers by academics in Western higher education and their subsequent collaboration across borders that would allow the world access to this new technology.

The first color televisions were introduced in the mid-1960s and consumers were poised to buy every new technology as it became available. The media were reeling as the television was erroneously predicted to eliminate the need to attend a movie theatre, read a newspaper or listen to the radio. Marshall McLuhan spurred on the media debate by speculating that it was no longer the message that mattered but the medium that delivered it. McLuhan believed that there was a unique relationship between the audience and the medium. He argued that a medium's inherent characteristics fostered a very specific type of relationship between an individual and a medium (Snow, 1983, p. 16-17). It was this media-user-based relationship that indicated computers would be effective educational tools. Computers could perform calculations that had been challenging, if not impossible, before their advent; causing early academics to develop an almost symbiotic relationship with these alluring machines. The academics most enthralled were in the fields of science and mathematics. By the late 1960's, Computer-Aided-Instruction (CAI) was also being tested in such diverse curriculum as foreign language study and the humanities (Suppes, 1977, p. 550). CAI quickly moved into the P-12 curriculum with students encouraged to write and understand early forms of computer language. In 1965, Intel's Gordon Moore wrote in *Electronics* that "the number of transistors in a dense integrated circuit doubles approximately every two years" (Moore, 1965, pg. 114). This became *Moore's Law* and has come to signify the unpredictable, almost exponential, rate at which major change and/or obsolescence occurs in the digital technology industry.

2.1.1.1 Developing countries in context

But what of the same time period in the developing countries relevant to this study? Were the benefits of CAI being felt there as well? Were the economic benefits of technology improving lifestyle? The Republic of South Korea (RSK) was rebuilding itself after the devastating Korean Conflict: 3-plus years of war that ended in 1953 with the division of the Korean Peninsula into North and South Republics. Pre-1970, the RSK would remain in the Western sphere. With the economic support of the USA, the RSK would develop a highly respected educational system that would encourage the teaching of English as well as other Asian languages. In 1995, the RSK would gain international *face* by applying to the OECD for the designation of Developed Country.

In the post-WWII era until 1970, many of the developing countries that now send students to Western universities were in turmoil.

- Vietnam had been divided and fighting wars since the First Indochina War began in 1946. In 1970, it was five years away from ending the most recent conflict with the USA. Yet it would continue to fight border wars with China into the 1980's (Butterfield, 1982, p. 187). It would be many years before diplomatic normalcy was established and Vietnam could begin to benefit from any Western innovations.
- In 1960, Malaysia ended its civil strife, the Malaysian Emergency, only to have the defeated Communist faction, under Chin Peng, restart the conflict in 1967. In 1962, Malaysia and Singapore were just finalizing how they would share the limited water resources, a long-unsettled issue that had threatened to inflame tensions on this small peninsula and further spread the growing insurgency in South-East Asia.
- Singapore's water filtration industry would advance science and technology in that country far ahead of its neighbors (Zhenyang, 2009). Singapore also instituted a bilingualism policy in 1960, officially making English the language of educational instruction. Singapore entered the digital age with an advanced educational focus similar to the RSK.
- India, fragmented by the recent death of its leader, would stabilize for a decade under the

rule if Indira Gandhi who nationalize education with an eye on the future of electronic and technological learning. India's biggest advantage was that many people spoke English as well as Hindi. But, as in so many large countries, India was decentralized and ruled by local factions with divided interests, limiting advanced educational changes to the more populated pockets of the country (Mahbubani, 2008). In 1961, only 15% of females in India were literate in any language.

2.1.1.2 China in context

In China the educational opportunities of a 20th-century student depended on their parents' economic status, social position and ability to maneuver amidst rapidly changing political intrigues. China recognized the global dominance of the English language; English instruction had been available for many years in elite private schools. From 1900-1950, China's illiteracy rate remained static at 85-90% (Ross, 2005, p. 3). English-language teacher, Chao Lian-ch'eng recorded that, by 1948, "English has been made one of the major subjects in Chinese schools. But the teaching of it has proved to be a great failure even as education in all aspects is faltering. The Chinese people had already endured over 20-years of civil unrest. Eight long years of war have wrought untold havoc in China's educational establishments, and the present Civil War in turn has been making the deplorable situation even worse" (ibid., p. 210). Not long after Lian-ch'eng's report, all academic structures were abolished and replaced by violent political *re-education*.

In 1949, Mao Zedong was closely allied with the Union of Soviet Socialist Republics (USSR). Wanting Stalin to be assured of China's anti-capitalist commitment, Mao sought to 'clean China's house' of all Western influences. Mao became openly hostile to the West: closing consulates, expelling diplomats, and bombarding ships in Chinese harbors. In June 1949, in an article in *People's Daily*, Mao formally declared himself in line with the USSR, stating that his foreign policy would be to 'side exclusively with one camp', the Communist Party (Chang & Halliday, 2005, pp. 340-341).

The purging of all Western influences would prove problematic as much of Mao's intelligentsia had received their educations in the West and virtually all of China's modern educational institutions had been founded by Western missionaries. Eliminating all West influence required banning English language instruction and that could not be achieved without destroying the entire Chinese educational system. In 1962, Mao Zedong opened a speech to a Communist Party audience by saying that "We need the policy of 'keep people stupid'". Though an avid reader, Mao publically labelled books as instruments of evil, 'politically empowering literacy' and restricting them from non-elite hands (Woodside, 1992; Pepper, 2000, as cited in Ross, 2005, p. 8). Following Mao's instruction to his inner circle that their goal was to keep the Chinese people ignorant, all arts, culture and learning would become subject to the newly-formed Red Guard: former students now without schools and actively encouraged to violence (Chang & Halliday, 2005, p. 476). As Western educators were introducing students to computer-enhanced math and science curriculum, China was implementing educational restrictions that would arrest intellectual growth and creativity for the next 20-years.

Throughout history the Chinese people have revered teachers and respected the institutions of education (Butterfield, 1982, p. 196). But in 1966, as the micro-computer age was dawning in the West, China's streets were controlled by rampaging students and young adults. In an account of the events of Red August of 1966, Wang uses documents and oral histories collected from survivors to paint a disturbing picture of the abuse heaped on both teachers and educational institutions. "In the summer of 1966, in all ninety-six schools covered by this research, students physically attacked teachers. A total of twenty-seven educators were identified as being beaten to death by students. (Teachers) were seriously injured and some committed suicide after suffering humiliation and torture" (Wang, 2008. p. 1). For a few short but highly effective years, the Chinese government enforced brutal political *re-education* while their traditional educational system crumbled.

2.1.1.3 Closing out the decade

In 1967, having achieved Mao's goal of terrorizing the general populace, the young Red Guard members were replaced by older cadres of army men. By 1968, over 16 million former teachers and students were subjected to *rustification*, dispersed to the hinterlands, scattered to villages and state farms. The students were sent back to the classroom; but with no textbooks, often no schools and their teachers condemned. Normal schooling would not resume until after Mao's death, a decade later (Chang & Halliday, 2005, p. 533).

In the West, by 1969, select groups within the military, governmental and scientific communities were allowed to exchange packets of information (bits) between their computers and the Internet was born (Ferdinand, 2000, p. 1). It was in 1968 that Bill Gates and Paul Allen were given access to a PDP-10 computer by a private company in Seattle who provided such opportunities to the Lakeside high schools. Gates and Allen would create educational scheduling software for the school system (VoteView, 2015). In 1969, the US DoD funded the use of Advanced Research Projects Agency Network (ARPANET) by universities and research laboratories. The Internet Protocol Suite (TCP/IP) developed for ARPANET incorporated work by both British and French scientists. ARPANET was the precursor of the modern Internet.

2.1.2 1970-1979

In the early 1970's, developed countries began aggressive integration of computer technology into all educational levels using policy guidelines such as the Conference Board of the Mathematical Sciences (CBMS) Standards for American computer integration with primary focus on the STEM curriculum in high schools. The emphasis was not on office-based desktop applications but on computer technology curriculum that taught how to write digital languages. Again the fields of science and mathematics developed most of the early computer technicians. During the 1970's, computers became an integral part of the P-12 classroom, brought to the attention of pre-service teachers by technology advocates in higher education. In *The Computer in the School: Tutor, Tool, Tutee,* Taylor (1980) presents the views of five American physics and mathematics professors instrumental in bridging the gap between higher education and the P-12 system. This book is a compilation of lectures, conference proceedings and journal articles from Alfred Bork, former physics professor at the University of California, Irvine; Thomas Dwyer, former mathematics and computer science professor at the University of Pittsburgh; Arthur Luehrmann, former Associate Director of the Lawrence Hall of Science at the University of California, Berkeley; Seymour Papert, former professor of computing in mathematics at the Massachusetts Institute of Technology; and, Patrick Suppes, former professor of mathematical studies at Stanford University. These academics introduced computers into education primarily because of their pre-computer fields of study - science and mathematics; their academic credentials; and, their geographical location: "up to the present the bulk of the use of computers for instruction has taken place in the United States, although I would assume that matters will be changing rapidly in this respect in the next several decades" (Suppes, 1975, p. 237).

In 1978, Bork opened a lecture by saying, "We are at the onset of a major revolution in education, a revolution unparalleled since the printing press. The computer will be the instrument of this revolution" (p. 5). Dwyer concurred, stating that "computers in education are revolutionary because they make possible great teaching in a system dedicated to mass education" (p.15). These five academics are representative of myriad educators who pushed forward the integration process. In their treatises we see that, globally speaking, by 1980 the computer quickly became so formidable and the forces behind computers in education so resolved, that any contradictory voices were muted and, with the passage of time, opposition diminished. Other disciplines may not have been as quick to integrate because the technology was initially seen as the domain of the hard sciences. But In *An Introduction to Educational Computing,* N.J. Rushby (1979) countered this elitism, "The association with mathematics and physics is purely historical and arises from the early uses of computers as machines for carrying out lengthy numerical calculations" (p. 77).

In 1970, another term was coined the *Dawn of the Digital Age* and in just a few years, very little that had gone before in educational learning would look the same. Yet, the speculations of these five academics regarding how computers might one day integrate into the learning process have proved prescient. Bork (1979) felt the computer had the potential to drive an electronic mail system, with the instructor broadcasting messages to the students (p. 10); Luehrmann foresaw how satellite communications might be broadcast directly to rooftop antennas to better serve educational needs (p. 153); and Papert (1978) predicted action-oriented computers that could draw pictures, make noises and make objects move around (p. 198). Suppes (1977) made a more professionally practical prediction "that the first important and significant use on a broad scale of computers at the university level may well be in offering a large number of courses that ordinarily have a small enrolment" (p. 240). But Dwyer (1976) envisioned computers enabling an instructional melding of the "philosophical point of view, such as the visions of Teilhard de Chardin, with the exercise of fantasy, the Star Trek phenomenon or the ability 'to go where no man has gone before'" (p. 20).

While they wildly speculated on the impact of computers in education, the human factors proved more predictable. Luehrmann wondered about the digital immigrant's effect on the acceptance and implementation of ICT in education. He noted that there would exist for several generations a horde of older people who, having failed to learn about computers during their school years, discover as post-graduates that their computer illiteracy is beginning to show (p. 141). But Rushby argues that the computer's effective use depends on the educational context in which it is used rather than on the teacher having empathy for it or knowing how to work it (p. 77). Rushby credits the teacher's effective planning and not their personal attitudes with the successful use of ICT. Dwyer concurs. In the West, opposition to integration was voiced, but Molnar (1973, p. 23) states the inevitable "computing is so compelling a tool that it cannot be stopped". What would come next though would quickly overwhelm everything that had come before. In 1975, the partnership of Gates and Allen formed Micro-Soft as the Dawn of the Digital Age, 1976, introduced the developed world to unimaginable social and economic opportunities.

2.1.2.1 Developing countries in the 1970's decade

In the developing countries it was a different scenario with a much different computer integration timeline.

- The RSK saw improving education as a way to support general economic rehabilitation after the Korean Conflict. By the mid-1970s, the RSK had centralized their school administrations and set up boards of governors responsible for standardizing curriculum. The RSK government had solid support from the Korean people to invest in education. Adult literacy was 80% (Lee, 2003, p. 10).

- The first half of the decade found Vietnam still at war with the USA and within itself. Vietnam did not reunify as one country until 1976. By that time the countryside was devastated and the death toll was catastrophic (Turner, 1972).
- Malaysia was in a period of rebuilding their economy and began educational reforms as well. During the British colonial period, Chinese and Indian immigrants had developed their own schools so those languages as well as English were taught in the classrooms of Malaysia. In the 1970's, a national language policy was established and English-medium primary and secondary schools gradually began switching the language of instruction to Malay, Mandarin and Tamil. This change would be complete by 1982 (Lillard & Willis, 1994).
- Singapore continued aggressively training its skilled workforce to support its industrialization plans that kept unemployment low.
- India continued to increase the number of schools offering public education and again benefitted from the influence of the British tradition of education (Mahbubani, 2008).

2.1.2.2 East meets West in the 70's decade

The PRC began the 70's decade in isolation. However, in 1972, Richard Nixon's visit cracked open the door between China and the West. Mao and Nixon met only once, for 65-minutes. Mao would not allow an American interpreter to be present so the official account of this meeting was transcribed in Chinese. Mao had successfully controlled the language of discourse and, thus, the historical record of the event. While the West applauded China's political re-entry onto the world stage, the Chinese people remained in a tightly sealed prison, rigidly quarantined from the few foreigners allowed into China (Chang & Halliday, 2005, p. 572).

By 1976, it was the Dawn of the Digital Age as CAI and university time-sharing systems were firmly in place in West. After Mao's death in 1976, Deng Xiaoping emerged as his successor and immediately began instituting the sweeping changes he had been covertly developing during Mao's final years. On the domestic front, re-establishing education was of primary political importance as it would help address many of the domestic issues Deng had inherited. But, while basic schooling expanded, a combination of closures of secondary schools and colleges, narrow ideological pedagogy and severe disruption of attendance negatively affected literacy rates, which in 1979 stood at 60.6% for school-age youths (Seeberg, 1990, as cited in Ross, 2005, p.13).

On the global front, Deng's challenges were far greater. Even with high domestic illiteracy rates, Deng could not ignore the need to reintroduce foreign language instruction as a means to global inclusion. English was firmly established as the language-base of computers, emphasizing the importance of higher-level English language abilities in global politics and corporate governance, and especially its dominance in the realm of international communication (Weinstein, 1983, as cited in Hargittai, 1999, p. 12). The ability to read, write, speak and comprehend English was so important in some areas that not speaking the language led to serious barriers in access to telecommunications technology (Barnett & Choi, 1995, p. 250). Deng was acknowledging the inevitable. Table 4 offers comparisons of the state of the digital world from 1970-1979. ICT developed in the PRC during this period are indicated in **RED.**

Table 4: The Digital World c. 1970-1979

Western Generations	China Generations	Gen Age	Status	Year	ICT Developments by Generational Age Chinese development in RED
Gen X: Counter-culture, Internet inventors, politically vocal, well educated, growing global awareness	**Post-70's**: Cultural revolution, academics in forced re-education, schools closed, political instability through 1978	**Digital Immigrants by Birth**	**Current University Instructors Aged 45 years and older**	1970-1972	Micro-computer, CAI, university time-sharing systems, floppy disk, mouse, concept of email
				1976	Dawn of the digital age (binary system technologies)
				1977	Online university, Ethernet, Chinese public education & *gaokao* re-established
				1978	Computer literacy movement, Plato educational software
				1979	Cellphone

(Damer, 2014, the Journal, 2013 & Rabkin, 2011)

2.1.3 1980-1989

Early in 1980, IBM and Microsoft officially joined forces and IBM agreed to use BASIC, FORTRAN, COBOL and Pascal computer languages. In a fortuitous move, the contract restricted IBM from licensing Microsoft products to third-parties but allowed Microsoft to do so. Late in 1981, the IBM Personal Computer (PC) debuted at approximately the same time Apple's Steve Jobs met with Gates (VoteView, 2015). The IBM PC would dominate the field for years to come and take many Microsoft products along with it. In 1981, Xerox introduced the *Desktop Metaphor*: an approach to user interface design intended to facilitate use of the computer keyboard and system by making the manipulation of information in the system analogous to the manipulation of physical objects on a desktop (Johnson, Ludolph, Smith & Irby, 1985, p. 548). The Xerox Star 8010 featured the most complete implementation of the *Desktop Metaphor* of any commercial systems until the 1990s advent of mature GUI (graphical user interfaces) on the Mac and PC/Unix/Linux systems. These systems were a full 15 years ahead of their time with sophisticated *what-you-see-is-what-you-get* (WYSIWYG) document composition, built in Ethernet, email, scanning networked laser printing, development environments including Smalltalk, and much more (Damer, 2014, pg. 1). Apple was in the wings with a slightly different approach that would modify the PC's aesthetic appeal and ease-of-use features. In January 1982, Gates and Jobs signed a deal in which Microsoft would supply Apple with a spreadsheet program, a business graphics program and a database program. Their first collaboration, the spreadsheet, was quickly released under the name Multiplan. The first Office desktop application was on the market and business quickly took notice. Introduced in 1971, the *mouse* made GUI easier but more programs were needed to employ the *mouse*. In 1983 Microsoft released Word which supported the mouse and had many business features to show off the mouse advantages. Computers were now available that would add to profitability and the market shifted away from computer languages and towards business cum academic applications (VoteView, 2015).

In 1982, the concept of the Internet was introduced to the public. In 1986, availability was expanded when the National Science Foundation Network (NSFNET) provided access to supercomputer sites in the USA from research and education organizations. With the ARPANET, educators had an interconnection of regional academic networks that marked the beginning of a transition to the modern Internet. In 1983, the release of the Apple II computer and Gardner's Theory of Multiple Intelligences coincided. Apple's interface was friendly and attracted educators and students alike. Educational software, developed over ten years earlier, was redesigned for the new computers. In the second half of the decade Microsoft released various versions of the long-overdue Windows Operating System (OS). This was the beginning of the availability of a low-end, affordable PC with a friendly GUI and plenty of business and graphics programs to attract not only big businesses but start-ups as well. This open-architecture encouraged more users to write code and the world became addicted to computers (VoteView, 2015).

In 1988, US Congress Office of Technology Assessment issued guidelines for technology integration into science and engineering curriculum at P-12 grade levels. Students were taught computer code as well as the supporting production applications. The digital video camera was introduced in 1985 and Microsoft PowerPoint and Excel in 1987. By 1989, first version of the Microsoft Office Suite was introduced providing full digital support for commercial business ventures. Adobe Photoshop, introduced in 1988 would be the first in a range of digital graphics production applications and would expand the creative use of the new digital hardware, cameras, printers, copiers and scanners. When combined with Gardner's Multiple Intelligences theory these digital production applications and the hardware that supported them would round-out the educator's options for creating an exciting new multimedia learning environment.

In China, the One-Child Policy was instituted in 1980 and changed Chinese culture overnight with the family's entire focus now on one off-spring. In 1986, Deng proposed basic education for all Chinese children but to meet the goals of the Seventh Five-Year Plan (1986-1990) and realize compulsory 9-year education, the system needed to train nine million new teachers. This allotment would include: 1 million teachers for primary schools; 750,000 teachers for junior middle schools; and, 300,000 teachers for senior middle schools (Hu & Seifman, 1987, p. 15). This would seem an impossible feat for a country with over 50% adult illiteracy rates, limited infrastructure, few resources or trained academics (Jiang, J., 2013, p. 111). Other Southeast Asian countries were rehabilitating their post-war economies: modernizing infrastructure and developing supply chains with the West. Japan, the RSK, Hong Kong and Taiwan developed educational systems with excellent reputations for STEM subjects. Western businesses were investing in Asian manufacturing and production as it was much more cost-effective in developing countries. But communications, tracking and shipping costs were prohibitive. The computer was about to change that as well. Table 5 offers comparisons of the state of the digital world from 1980-1989.

Table 5: The Digital World c. 1980-1989

Western Generations	China Generations	Gen Age	Status	Year	ICT Developments by Generational Age
Gen Y: Educated, use ICT tools: computers, cell phones, A/V & multimedia efficiently, social & political activism. Similar characteristics occur in China post-2000.	**Post-80's**: *Little Emperors*, 1-child policy will transform society & economy, high illiteracy rates. No trained educators for schools. Transitional generation with no ICT awareness or access.	**Digital Natives by Birth**	**Current University Instructors Aged >35 years**	1980	Educational software and teacher authoring
				1981	Microsoft (MS) Disk Operating System
				1982	IBM PC, AutoCAD architectural program, laptop with folding screen
				1983	Gardner's multiple intelligences, Apple II, MS Word Office Application
				1984	Compact Disc Read-Only Memory (CD ROM), Apple Mac PC, intra-networks
				1985	Integrated Learning System (ILS), MS Windows Operating Systems, Digital Video (DV) camera
				1986	MS PowerPoint and Excel Office Applications
				1987	Adobe Photoshop software
				1988	MS Office Suite Office Applications
				1989	Educational software and teacher authoring

(Damer, 2014; the Journal, 2013 & Rabkin, 2011)

2.1.4 1990-1999

Internet use grew rapidly in the West from the mid-1990s to the early 2000s. In 1994, only 4% of American P-12 classrooms had access to the Internet but by 2002, 92% had access. Multimedia PCs, digital cameras and the graphics processors needed to fulfill their potential were introduced early in the decade. Post-1992 digital innovations came rapidly. In 1993, 3D Studio Max, the animation program used in the making of the movie Jurassic Park was released to consumers and quickly became popular in university and vocational course work. By the end of the decade consumers would be familiar not only with the Internet but a rash of acronyms, abbreviations and vocabulary that did not exists pre-Internet. New hardware such as universal serial bus (USB), media player3 (MP3), broadband networks; computer programs and applications Quicktime, portable document format (PDF), Joint Photographic Group (jpg); and Internet terms Google search engine, World-Wide-Web, eMail, spam, Yahoo, Hotmail, Babelfish and Google Translate (Damer, 2014).

In 1997, National Agency for Higher Education produced the National Policies for the Internationalization of Higher Education in Europe stating ICT integration efforts across all level of education in eight EU countries, Russia and Central and Eastern Europe. Though integration differed by country, standards were set with mutual attainment as the goal. That same year, Singapore set lofty achievement standards when the Singapore Ministry of Education instituted the comprehensive National Information Infrastructure and followed up immediately with support and training for all educational levels in a program it dubbed Thinking Schools, Learning Nation (Goh, 1997, Pg. 1). Singapore's early success with stabilizing their educational system would cause the Chinese Ministry of Education (CMoE) to partner with Singapore in the development of the first foreign-owned for-profit International schools allowed in China after the Cultural Revolution. As China recognized its need to welcome yet control the West within its borders, the concept of sanctioned industrial developments to house Westerners in a style much above the average Chinese was developed. These industrial parks included education for the Western children but not the domestic Chinese students who were forbidden, by law, from attending non-domestic schools.

China expressed its technology integration goals in the Eighth 5-year plan covering the years 1991-1995. However, they faced many challenges not the least of which was the lack of centralized control of the schools. In 1997, the CMoE launched The 21st Century Teaching Content and Curricula Innovation in Higher Education Project to bring a fundamental change of pedagogy and educational philosophy, an innovative modelling of talent cultivation and the modernization of teaching facilities, teaching content and curriculum design (He & Xiao, 2004, as cited in Hu & Webb, 2009, p. 144). This initiative focused on computer education but only in higher education. In 1998, China officially embarked on the 985 Project. Reform would focus on higher education following a decision to digress from the established norm of focusing on secondary education and instead concentrate on reforming the university system (Ivanov, 2013, p. 1) China developed the consumer side of the Internet by providing its citizens with a number of online services. In 1998 and 1999, the PRC sanctioned Tencent/QQ-virtual goods and online service provider; Dangdang-online shopping; CTrip-online travel services; Alibaba-global business-to-business (B2B) wholesaling of Chinese products. Online learning was not yet available but consumers and commercial interests were well supported by a government who maintained strict control of the Internet (Rabkin, 2011, p. 74). Table 6 offers comparisons of the state of the digital world from 1990-1999. ICT developed in the PRC during this period are indicated in **RED.**

Table 6: The Digital World c. 1990-1999

Western Generations	China Generations	Gen Age	Status	Year	ICT Developments by Generational Age Chinese development in RED
Gen Z: Globalizers digitally connected, postmodern, live in an ICT environment which they regularly modify and personalize for education, business and social purposes.	**Post-90's**: Traditional Confucian education. Internet access is severely restricted by government but some Western commercial and social media begin to filter through the Great Firewall. Financial opportunities increase as global commerce grows.	**Digital Natives by Birth**	**Current University Students Aged >25 years**	1990	Multimedia PCs, digital camera, 3D Studio Max animation software
				1991	Graphics processors
				1992	Dawn of the Internet Age, CSIRO wireless, IBM laptop
				1993	World Wide Web (WWW), email, PDF
				1994	Yahoo, QuickTime multimedia software, JPG, spam, Amazon shopping
				1995	Dial-up Internet, MS Windows 95 browser, Adobe Flash software, USB, audio coding format MP3
				1996	Hotmail, Google Translate, Babelfish
				1997	Web logs (BLOGS), broadband transmissions
				1998	ISTE Internet standards, Google search, Autodesk 3D Maya. Tencent/QQ
				1999	Wi-fi, MySpace, Internet music/Napster. Dangdang, Ctrip, Alibaba B2B

(Damer, 2014; the Journal, 2013 & Rabkin, 2011)

2.1.5 Post-2000

From most every Western or developed country the new century brought publications and proposals of lofty yet attainable integration goals at all levels of education. An excellent compilation of the various policy papers was collected in the International Handbook of Information Technology in Primary and Secondary Education: Part One; a 2000-page report created by Springer Science +Business Media for UNESCO (Voogt & Knezek, Ed., 2008). This report includes 76 chapters, from 136 contributing authors representing 23 countries and five continents. It creates a chronological/historical context for examining the development of instructional technology around the world. It notes that “the challenges of IT in education have been studied for 40 years”, providing a rudimentary structure for third world countries in differing stages of IT experimentation. From 2000 onward, the integration of ICT into all levels of Western education were mandated and therefore assumed to be true. The systems that would support the integration and development of complimentary curriculum were in place, justified and funded in the West.

In 2005, the following table was prepared for UNESCO showing the escalating steps required to meld technology with education. It provided a guide on which developing countries would monitor their progress and plan future development. Table 7 indicates the steps delineated into Basic and Extended Core groups.

Table 7: Differing levels of technology integration in education

Basic Core	
ED-1	% of schools with electricity
ED-2	% of schools with a radio set used for educational purposes
ED-3	% of schools with television set used for educational purposes
ED-4	Student to computer ratio
ED-5	% of schools with basic telecommunications infrastructure or telephone access
ED-6	% of schools with an Internet connection
ED-7	% of students who use the Internet at school
Extended Core	
ED-8	% of students enrolled by gender at the tertiary level in an ICT-related field
ED-9	% of ICT-qualified teachers in primary and secondary schools

(UNESCO, 2005)

Across the country, China was early in these development stages. However, the Chinese educational experience differs greatly by geographical region. In 2000, Boyle (p. 150) commented that China is a vast geographically and it is impossible to generalize about it sensibly. It is not a monolithic society, but a complex interlocking web of often contradictory relationships and interests. It is in the progress of rapid change which instantly converts today's common sense judgments into tomorrow's aberrant anachronisms (cited in Jung, 2006, p. 14). China's need to control the Internet would retard their rapid integration plans nationwide. The existence of a monopoly in the telecom sector of a nation seems to have a considerable negative impact on that country's Internet connectivity (Hargittai, 1999, p. 710). Schools in major metropolitan areas would be the first to see improvements in technology-related curriculum but for many years even these schools would languish between the ED-5 and ED-6 core levels.

China's focused more on basic issues. In 1996, only one in six Chinese 17-year-olds graduated from high school: the same proportion as in the United States in 1919. By 2013, three in five young Chinese graduated from high school, matching the United States in the mid-1950s (Bradsher, 2013, p.

4). For the elite, China encouraged access to the West even as it occasionally trimmed back on provisions and commercial opportunities for its general populace. China may have had cause for concern. As a means of communication [the Internet] has the potential to revolutionize political activity far more profoundly that the telephone or the television ever did. This led to predictions that it will completely revolutionize government and democracy… as authoritarian regimes find it difficult to survive (Ferdinand, 2000, p. 1). Yet, the greatest impact of the Internet was not in politics but in commerce. As it limited citizens' access to foreign media, the PRC continued to sanction and allow commercial online ventures that originated in China. In 2000, Baidu was introduced as the Chinese alternative to Google. In an attempt to force Baidu's use by the Chinese public, the PRC government blocked access to Google and all of its many service beginning in 2006. It was immediate and all-encompassing, eliminating access to Gmail, Google search engine, Google Docs, Picasa photo studio and most Western social media. The seemingly arbitrary ban reinforced the insecurity and skepticism of China's Western business partners. Yet it set the stage for these partners to develop alternative access channels for later use such as virtual private networks (VPN).

Chinese industrial parks illustrate the East-West technology balancing act and have presented both social problems and economic solutions since their inception. Western businesses expected the open Internet access they required to conduct global business and their Western families required full access to other parts of the world. China did not take issue with these needs and provided segregated services to their designer industrial parks. But as more Chinese nationals realized the considerable difference in Internet access, issues began to arise. For example: a Western passport would gain access to Western Internet, television content and news from around the world. The PRC commonly went to *black screen* blocking politically objectionable content. Such limitation were in place to control political thought and dissension but in the greater scheme may have limited the access of thought and creative research that would ease the PRC into the global economy.

Many International schools lost outside contact and access to the free resources used in daily instruction. Like the Western businesses, their work-around was the VPN. However, finding an effective online VPN source-file was difficult as Internet access was blocked to all searches for 'VPN'. Westerners, returned from abroad with offline links to VPN sites hand-carried on flash drives, shared them with colleagues and new "off-the-grid" connections were set up. These illegal connections were detected and immediately blocked. An endless cycle developed as many VPN users changed their uniform resource identifier (URL) monthly to remain ahead of the censors. Chinese businesses were more handicapped than their Western counterparts, unable to conduct digital business-as-usual and unable to reasonably explain to those outside China, the precise nature of the threat.

> "If you're not working with a the right company in the right capacity, and if you're not an International student with access to a university VPN, then you're going to have to go out of your way to get to certain sites. And yet, how inconvenient is this? And, for the average Chinese Netizen, is accessing blocked sites really worth the hassle? If you're a part of the Chinese media culture, it hardly matters in many respects, because Chinese sites can provide most services and types of information. You can do your shopping on TaoBao because eBay isn't really necessary" (Osse, 2011, p. 2).

The effectiveness of the ban soon waivered but the point had been made that control was complete and disruption was not out of the question. The 2000 decade found the West moving ahead in both innovation and integration of educational ICT. Digital innovation in China was best demonstrated by the growth in online commercial applications that could be effectively government controlled. China encouraged nationally sanctioned commercial sites: TaoBao (2003, online shopping); Dianping (2003, urban city entertainment guides); Hudong and Baike (2005, Wikipedia clones); Sina Blog (2005, weblogs); Renren (social networking); Tudou and Youku (2006, social networks); Sina Weibo (2009, social network); and Qiyi (2010 online entertainment) (Rabkin, 2011, p. 73). Table 8 offers comparisons of the state of the digital world from 2000-2009.

Table 8: Digital ICT 2000-2009

Western Generations	China Generations	Gen Age	Status	Year	ICT Developments by Generational Age Chinese development in RED
Gen AO (always on): Nimble multi-taskers, instant gratification, quick fixes, low on patience & deeper knowledge/critical thinking skills. ICT environment complete - do not remember analogue technologies	**Post 2000's**: High educational expectations leads to student stress, financially secure due to parental conservatism and growing job opportunities. Heavily restricted global Internet access encourages use of China commercial websites. No comprehensive ICT integration into K-12 education.	**Digital Natives by Birth**	**Future University Students Aged >15 years**	2000	Australia, China, UK & US issue ICT integration plans, global Internet, smart phone, Baidu
				2001	Wikipedia open forum encyclopedia
				2002	Blackberry mobile devices
				2003	LinkedIn social media, iTunes. TaoBao, Dianping
				2004	Facebook, Flickr social media
				2005	Gmail, Google Earth, YouTube. Hudong & Baike, Sina blog, RenRen
				2006	Cloud computing, Google docs. Tudou & Youku
				2007	ISTE advanced ICT standards, Android OS, Apple iPhone
				2008	Online & distance learning K-12, Google Chrome OS, Twitter
				2009	Fully integrated classrooms in Western P-12 education. Sina Weibo

(Damer, 2014; the Journal, 2013 & Rabkin, 2011)

2.2 Chapter summary

Proving this research thesis relies in part on drawing logical conclusions from historical documents, accounts, observations and timelines regarding the simultaneous introduction and use of ICT in

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Eastern and Western education or the lack thereof. A review of various governmental policy statements from both developed and developing countries during these formative years indicates a consensus of intent in the development of similar education integration plans. However, adherence to these plans was inconsistent between global educational systems often due to political events that superseded the best intentions to achieve the stated integration goals. The timeline comparison of the major events in digital innovation presented in Chapter Two supports the logical conclusion that students educated in many non-Western developing countries should not be expected to have developed ICT skills commensurate with those of their Western-educated counterparts. The history of ICT integration as related here strongly suggests that academics should have a clear and reasonable doubt about the inclusion of ICT into P-12 curriculum in non-Western countries especially those countries where the native language is not English. Skepticism regarding the incoming foreign students' ICT skills and how this will affect their ability to achieve a level of performance commensurate with Western university coursework is justified. An appreciation of the limitations imposed by the unequal integration of ICT into global P-12 education should pose a challenge not a barrier to educators, parents and students, all of whom share the singular goal of each student completing a successful academic career.

3 THE EVOLUTION OF THE ACADEMIC ICT GAP

"There is no reason for any individual to have a computer in his home."
(Ken Olsen, President of Digital Equipment Corporation, 1977)

The young Asian student steps off the plane and into a most exciting adventure. Though not yet 20-years-old, she/he has spent almost half her/his life preparing for this challenge. She/he is trying to focus and not be inundated by her/his hopes and dreams, the plans for the future which her/his family has rested on her/his success. To prepare, she/he has applied her/himself to science, mathematics, history and most importantly English-language studies. From now on the English language, so different from her/his native language, is all that she/he will speak, read, hear and write at university. She/he is told she/he is prepared for university and has passed all of the qualifying literacy and numeracy exams required. But she/he has not been trained in an important adjunct of the English language: digital literacy using ICT. As she/he discovers that mastery of ICT is primary to all aspects of Western higher education, her/his confidence will wane as her/his fast-fingering skills, honed using online social media, are not enough to bridge the Academic ICT Gap. In her/his home country she/he did not have more than a few formal computer courses. Her/his teachers were not highly computer-literate and her/his school was not reliably 'connected'. She/he has not academically formatted a word document; entered data, a formula or computation into an excel spreadsheet; created a multimedia presentation by her/himself; conducted a research project; taken an online course; or communicated online with teachers. In addition to these basic skills she/he also lacks the bespoke RPS she/he now finds in her/his Western coursework. Each time she/he goes to class it requires three repetitions of the coursework before she/he feels that she/he understands and can complete assessment tasks. First, she/he sits in class and watches the professor's body language, reads lips when the language is confusing and takes notes. Later, in the library, she/he will review the online class notes and multimedia slides. Finally, back in her/his room, she/he will read the texts again, refer to the notes and complete her/his work. She/he has no time to learn even the most rudimentary ICT. She/he is slowly beginning to fail. Failure is new to her/him and she/he has no experience in how to reverse the decline.

The one person who sees her/his academic decline is her/his professor. They sees the confused, often blank, look on her/his face and slows down the class until it seems she/he has caught up a bit. Looking directly at her/him, they will talk slower and more distinctly. While others are working, they will demonstrate ICT skills and suggest where she/he might find examples of others' completed work.

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But this is not their job and classes have schedules and criteria to meet. Only so much can be done when instructional challenges are this pervasive as hers/his. Unfortunately, this foreign-educated student and many of her/his counterparts lack the ICT skills that have been seamlessly integrated into Western education since the 1970's but not yet prioritized in developing countries. This student has mastered the technical content but cannot academically express her/himself in a rigorous academic format. Both the student and their professor are victims of the Academic ICT Gap.

3.1 Research questions

This research was conducted to investigate the Academic ICT Gap.

Research Question 1: *What are the ICT skills of a non-Western-educated P-12 student?*

Research Question 2: *What ICT skills are required to undertake a Western university program?*

Research Question 3: *What is the nature and extent of the Academic ICT Gap between the ICT skills of a non-Western-educated P-12 student and the ICT skills required to undertake a Western university program?*

The primary focus of this literature review is to examine historical and current writings and research that address the timeline and environment of computer innovation and use: in particular, the integration of ICT skills into global and regional education. I will present supporting evidence that the Academic ICT Gap exists or I will concede that instead, ICT has been so well integrated into global education that it is actually *hidden in plain sight* (Fluck, 2003). I will present an overview of successful integration processes and the steps involved; and compare it with less aggressive, restricted integration efforts. I will examine performance indicators such as: if university administrators write intelligible emails; if their institutions conduct instruction online; if their educators create digital content; and their students possess *fast-fingering* skills, does this constitute successful ICT integration. A review of opinions from a variety of stakeholders, both past and present, provides perspective on the nature of the ICT in question, why it is important to so many and what might be at risk if we do not close the Academic ICT Gap. Again, when possible, documentation will be appropriate to the time period under discussion.

3.2 Western academics and computers

These four statements are prima facie:

- Computer technology was invented by economically-developed, first-world countries

- Computers "*speak English*" (HTML)
- Western universities were the first public institutions to use computers
- ICT have become ubiquitous in Western education.

3.2.1 Historic context of ICT adoption in Western higher education

In 1979, Luehrmann predicted that resistance to computer technology was inevitable and possibly would arise along age/generational lines. He was blunt "Computer technology today is entering a world populated by computer illiterates. The technology, in short, is far ahead of our ability to make use of it" (p. 138). The assumption that age was a defining factor in a person's computer literacy was put forth by Marc Prensky (2001) who used the advent of digital technology as the demarcation dividing the *digital immigrant* (those born before 1980) from the *digital native* (those born after 1980). Based on birth year, Prensky made sweeping generalizations about a person's affinity for using ICT. His classifications immediately became popular sound-bites. But other anomalies that might account for the digital native/digital immigrant narrative were observed. For example, it was noted that unlike traditional native/immigrant relationships, in higher education it was the immigrant/educator who instructed and the immigrant/administrator who held the decision-making power. Questions arose regarding the affect the first of the digital native university instructors would have on higher education. Would they emphasize emerging technologies over the traditional ICT and alienate the remaining digital immigrants in education? Were the younger instructors more like the students than fellow academics? University staff and students often seen as being on opposite sides of a digital divide instead may have been united in their lack of familiarity with new and emerging technologies (Kennedy, Dalgarno, et al., 2008, p. 490). A growing number of today's educators are themselves digital natives and many are products of foreign P-12 educations indicating they may be lacking the same ICT production skills as their digital native students. "The relevance of specific ICT skills and knowledge is driven by a high level of technological change that results in continuous revision of what counts as both 'basic' and 'advanced' skills and knowledge in the field" (p. iii). Prensky's ageist divisions have been examined by theorists and have devolved into mere talking-points. Instead of age, research indicates that there is usually another form of the adaptive learning processes: avoidance, fear, reticence, skepticism or hesitancy, responsible for variations across age groups when learning a new technology (Brown & Czerniewicz, 2010, p. 361; Clow, 2009; Georgieva, 2009, p. 2; Goodman, 2012, p. 2; Hargittai, 2010, p. 108; Jones, C., et al., 2010, p. 731; Kennedy, Dalgarno, Bennet, Judd, Gray & Chang, 2008, p. 490; Li & Raneiri, 2010, p. 1041; MacLean & Elwood, 2009, p. 78; Margaryan, Littlejohn & Vojt, 2011, p. 437). A logical explanation for differing attitudes towards ICT uptake is not always welcome. Mistrust of this mystique provides a rationale for modern-day Luddites and "digital xenophobes, who've never actually spent any time in the digital world, but still bang on about how awful (they assume) things are there" (Brumley, 2013, p. 2).

In 1990, the Apple Computer Company's Classrooms of Tomorrow Research was investigating the assimilation process experienced by teachers and students provided with constant access to computers. No attempt was made to replace existing instructional technologies with computers. By design, the classrooms were true multimedia environments where students and teachers used textbooks, workbooks, manipulatives, white boards, crayons, glue, overhead projectors, televisions, musical instruments, etc., as well as computers. The operating principle was to use the media that best supported the learning goal. This early research identified teachers as pragmatists, willing to change current practices only when presented with more relevant, proven methodologies. To overcome their pragmatism, it proposed a challenging assimilation process that research indicated could take years to accomplish. To facilitate change, researchers stressed the importance of regular interaction with colleagues and administrators who actively supported the fundamental changes brought about by instructional technology (Dwyer, Ringstaff & Sandholtz, 1990, p. 7).

In 2000, the Australian National Education Performance Monitoring Taskforce (NEPMT) dictated the integration of *broad based ICT skills and knowledge* into the established national literacy and numeracy curriculum. That same year, what would become the most commonly used small office management applications, Microsoft Office Suite 2000, would add Access (data base), Outlook (contact management), Publisher (desktop publishing) and a range of small business tools further enhancing desktop publishing package. Multimedia applications improved audio, image and video manipulation. Teachers were encouraged to experiment with the technology provided them and to collaborate with colleagues, sharing their successes and failures as together they created the first working examples of ICT integration based on local research conducted on local students. Many educators were provided advanced bespoke applications for use with specific curricula which required the mastery of specific skills. These digital immigrants were under continuous pressure to be trained in the new ICT and to adapt to Internet connectivity while they crafted unique computer-based projects for their students. Educators were acutely aware that the development, planning and integration of ICT curriculum would strain both their time and their patience (Bertram & Waldrip, 2013, p. 2; Pellicone, 2001, p. 2; Usluel, Askar & Bas, 2008, p. 263; Waycott, Bennett, Kennedy, Dalgarno & Gray, 2010, p. 1203). Pre-Internet, curriculum focused on the basic offline ICT skills needed to write compositions, calculate spreadsheets, manage information data and create multimedia presentation. Because these applications were included in the P-12 grades in the early years, educators may have assumed seamless integration had been achieved and that future students would continue to receive basic skills training. Post-Internet, innovative teachers began working with emerging online ICT. At some point academics, though they continued to use traditional ICT, marginalized the importance of teaching these skills. By 2000, the first generation of digital natives was entering university and has since earned diplomas, many in education. At best these new teachers may have had no more than ten years exposure to any learning technology. They may lack the same ICT skills as their students. When comparing the digital natives' and the digital immigrants' exposure to basic ICT it is the digital immigrant that has preserved the traditional ICT skills so critically important in the students' daily academic work. Prensky may have identified the digital native's affinity for emerging commercial technologies but the digital immigrant was the guardian of the ICT important for students' performance in higher education and post-graduate employment. (See Appendix 3: Timeline of ICT Developments East and West by Generations)

3.2.2 Historic view of ICT integration in Western primary through secondary education

Primary and secondary education did not immediately benefit from computer technology. In Tutor, Tool, Tutee (Taylor, 1980) Luehrmann notes that colleges and universities initially acquired computers because of the research needs of the faculty (Ibid. p. 144). However, Papert, influenced by his work with Piaget (Ibid. p. 159), and Suppes, known for his pioneering use of IT in mathematics and language instruction (Ibid. p. 213), are excellent examples of academics who would soon developed programs for the P-12 levels.

Effective national integration programs began to evolve in response to international research into what ICT skills the global economies of the future would require. Following the lead of the National Agency for Higher Education's advances in technology standards for the EU and Russia, the National Research Council (1999) put forth US standards for technology literacy. These shared visions dictated similar integration programs in all Western and Eastern developed countries. In their eighty-eight page report to the NEPMT, Cuttance & Stokes (2000) detailed existing ICT integration across the Australian states and territories, and then proposed ways to attain stated national goals while maintaining the independence of the state educational systems. Though they differed somewhat in procedure, each state program supported aggressive ICT integration into P-12 education. Early intervention was intended "to instill, and clearly recognize, both the broad based ICT skills and knowledge that all students need to acquire and more specialist skills and knowledge that students planning ICT specific post-school vocational pathways need to acquire" (p. iii). Governments around the world developed plans similar to Australia's national integration program which implied that domestic students who completed an Australian P-12 educational program would master the

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Western-standard ICT skills required to complete an academically rigorous Western higher education program.

This planning influenced their pre-service training programs. In 2001, the report *Making Better Connections* was prepared for the Australian Commonwealth Department of Education, Science and Training (Downes, et al., 2001). It modelled the teacher professional development that would be required to support ICT integration into classroom practice. It included a comprehensive framework of best practices for seamless integration into the classroom. It provided a practical scaffold of achievements that teachers could implement on a daily basis and use as benchmarks for their integration progress (Retrieved from Way & Webb, 2007, p. 560).

Type A: ICT as an object of study

- Encouraging the acquisition of ICT skills as an end themselves
- ICT skills are taught as a separate subject
- Traditional subjects continue to be taught the same

Type B: ICT as tool for learning

- Using ICT to enhance students' abilities within the existing curriculum
- Whole school focuses on integration of ICT
- Some teachers change their pedagogical approach through the use of ICT while others continue to use existing pedagogical approaches

Type C: ICT as integral to both subject matter and pedagogy

- ICT transforms the classroom
- Introducing ICT as an integral component of broader curricular reforms
- Teacher's pedagogy and content are changed through the use of ICT

Type D: ICT as integral to reform of schooling

- ICT transforms education
- Organization and structural changes take place to schooling itself
- Student learning through authentic, challenging multidisciplinary tasks
- New roles for teachers and students
- Culture of inter-related learning within and beyond the school
- Changes in the professionalism of teachers

Choosing ICT that meets the ever-changing learning environment is challenging without a framework supported by data and documentation. The selection is often left to teacher preference: a haphazard approach. The focus has to be on specific technology that adds value to the educational experience and faculty needs to guard strongly against administrative processes and procedures that threaten to overwhelm and detract from the value of teaching and learning (Moodly & Abu, 2014, p. 197).

3.3 Foreign students - modelling the Chinese prototype

“Foreign students, who come from non-European backgrounds, Third-World countries and/or Eastern countries, tend to suffer more stress in adjusting to (US) campus life” (Yan & Berliner, 2009, p. 942). The Academic ICT Gap is an additional stressor: an assimilation issue that foreign students are not aware of until they confront the rigors of a Western university program. There are three primary sources of academic stressors: the interaction between Chinese students and academic staff, the academic achievement and the issues associated with the language barrier (Lu & Short, 2012, p. 4). The effective use of ICT is instrumental in each of these three areas. ICT is an adjunct to all forms of language acquisition for non-English speaking students. As English-language-learning tools, ICT provide support mechanisms such as grammar and spelling checks, the ability to arrange thoughts and develop ideas, comparison of the validity of research sources and others.

The Eastern students’ learning style may contribute to the Western university’s ignorance of the Academic ICT Gap. Eastern students do not question their teachers but accept that any failures in learning are their personal responsibility. To Chinese students, exams are almost a religious ritual, admitting priests to a cult, a kind of theocracy (Butterfield, 1982, p. 198). When students pass the IELTS and are accepted at a foreign university they believe they are linguistically prepared. Students recognize the value of ICT but they expect their instructors to train them to effectively use the ICT required for coursework e.g. use of CMS, hardware and software-including bespoke and basic software. But instructors need support, encouragement and possibly incentives to do so (Dahlstrom, Walker & Dziuban, 2013, p. 1). University instructors teaching basic ICT skills is not a productive use of their time or training. Many of these skills are common to all coursework and should be in place when the student enters the institution. “If students do not have any idea of how to work with a word processor, a spreadsheet, a web browser, etc., it will be hard for them to use a virtual learning environment, complete assignments, search on the Internet, etc.” (De Wit, Heerwegh & Verhoeven, 2012, p. 16).

Even if students believe they have these skills their performance level may be uncertain. When computer users were surveyed as to their perception of their ICT skills and then tested for their actual ICT skills the actual abilities differed greatly (De Wit, Heerwegh & Verhoeven, 2011, p. 220; Grant, Malloy & Murphy, 2009, p. 154-56; Keengwe, 2007, p. 169; van Braak & Goeman, 2003, p. 656; and Wallace & Clariana, 2005, p. 141). This is a reoccurring phenomenon with no clear, consistent explanation for the difference in perception and reality though it may indicate that there are too many individual and technological factors at play in the self-analysis process. In 2013, PRC students accounted for 29% of all foreign students enrolled in Australian higher education. This enrolment, when combined with the five other higher ranking Southeast Asian countries accounted for 62% (203,749) of all enrolled foreign students (Australian Bureau of Statistics, 2013). For this reason PRC students were used as the foreign student prototype for this study. The issues considered here will reflect performance challenges from an Asian perspective: culture, language, educational philosophy, economic environment and historical perspectives juxtaposed with the West.

3.3.1 Historic context of English-language learning in China

China's 20th century social and political history sheds doubt on the country's ability to attain Western levels of ICT integration. The benchmarks discussed above require infrastructure, trained educators, Internet connectivity and, most importantly, an English-speaking cohort: which has begun to develop on a broad scale in China only recently. Creating an English-speaking cohort is an ongoing struggle for a national school system fragmented by years of unrest. In 1992, as the West entered the Internet Age, the CMoE instituted two conflicting policies affecting P-12 education: compulsory schooling was expanded from primary through junior secondary (grades 7-9) level and school funding was decentralized. Ostensibly, this was intended to raise attendance and expectations while lowering national funding. Instead, this conflict of directives undermined mass education efforts, causing a 'retrenchment of village schools and declining enrolment numbers' (Ross, 2005, p. 37). The Chinese educational system remains highly centralized and ICT-related school policies, developed by the CMoE, while mandatory are often applied unevenly. The Ministry promotes ICT use, but links this explicitly to the prescribed national curriculum, the central examination system and teacher-led didactical strategies. This approach does not invite a thorough reflection on school-based policies (Zhang, 2007, p. 303). According to CMoE statistics, in 2001, 100,000 Chinese secondary and elementary schools were integrating new technologies into existing classroom practices, an effort involving 50 million students, 3 million computers and 150,000 computerized classrooms (CMoE, 2003). The needs, infrastructure and training required at the primary and secondary levels remain unaddressed (Zhang, 2007, p. 304). Logic would require that these claims be questioned as these statistics imply that marked improvements were achieved only four years after the initial 1997 higher education initiative, which omitted any mention of ICT in P-12 curriculums.

3.3.2 Modern Chinese education - classroom and curriculum

Since the days of Lian-Ch'eng, China has balanced Western and Eastern educational models. The one-child policy, instituted in 1980, produced generations of *little emperors* characterized as sole male heirs, spoiled by parents and grandparents, with few family responsibilities and unable to compromise in social situations (Lim, 2010, p. 4). These only children also carry the expectations of their elders: to rise above obstacles, provide hope for the current family and secure the family name. Many students are constantly pushed to higher performance. (ibid. p. 5) Achieving the family's goals is a matter of *face* and the threat that the child may lose *face* for the family is a pressure few Westerners understand. While it is not necessary for one to strive to gain *face*, losing *face* is a serious matter which will, in varying degrees, affect one's ability to function effectively (Ho, 1976, p. 867). In many cases, maintaining *face* begins with learning the English language so the child can attend the schools that will further the family goals. The ability to speak, read, write, translate and understand the English language, necessary to both ICT use and university work, remains a formidable challenge for the Chinese student. English is phonological, so English readers can sound out the words when they read; written Chinese is not, allowing hundreds of mutually unintelligible Chinese dialects to use the same written script. English speakers access audio-sensory parts of their brain to *hear* text, while Chinese speakers use a visual-sensory part of their brain to *see* text. It is both a literal and a cultural exercise. To teach a Chinese person to read well in English thus entails a significant rewiring of the brain, and while science says this is possible, there is nothing quick or easy or fun about it (Wolf, 2007, as cited in Xueqin, 2011).

For Chinese students, the digital divide between *haves* and *have nots* is personal not national. It is an individual's circumstances that determine Internet accessibility. Government control over access points has helped create China's 2nd level digital divide. Students often depend on home computers and Internet café to complete schoolwork. These practices indicate that for many students their research and communications skills are self-taught (Zhao, et al., 2011, p. 1406). In 2010, Li & Ranieri surveyed over 300 middle-school students from Ningbo City, south of Shanghai regarding their ICT access and use. Of concern to the researchers was "the digital gap due to uneven opportunities for teenagers to access digital tools, and the emerging need to integrate the use of ICTs within the school system and into the curriculum (p. 1030). One discovery consistent with other researchers was that the students needed to have access to PCs and the Internet outside of school as the schools did not provide them. While 88% of the students had PCs at home their usage and connectivity was limited with only 32% of the students using the PC frequently. They did not frequent Internet cafes. Still the students' believed they had developed sound technical skills. However, a personal assessment of their skills proved much lower than their actual abilities. When responding to questions regarding ICT technical skills in word processing and other common production tasks, only 25% attained a score of 70% correct (p. 1040). These researchers considered it a 'significant result' that being familiar with ICTs does not entail being able to use ICT in a competent way (p. 1041). This is a logical outcome for students' who depend on self-taught computer skills and it not only places them squarely in the Academic ICT Gap but in the 2nd level Digital Divide, incapable of high-level research or interface with online academics. Though Li & Ranieri's research methods were faultless, their results were inconclusive because of inconsistencies in the availability of ICT in across all locations.

China's growth as an international power has forced changes in their domestic educational market. Expatriate parents, working in China, have demanded area schools that deliver curriculum comparable with what their children would find in their home country. International schools were the first to take on this challenge. Compared to local schools International schools are expensive, well provisioned and exclusively foreign. By law, children holding PRC passports are not allowed to enroll in the foreign-owned International schools that have sprung up around every major metropolis. Every day Chinese parents see foreign students being bussed to and from their homes, competing in sports teams and taking part in the extracurricular activities considered necessary in Western education. One extensive industrial complex, Suzhou Industrial Park (SIP), was built in 1995, and by 2005, housed over 3,500 international corporations. The Suzhou area is an experimental educational zone, one of the first to introduce Western academic testing services and to limit English language instruction in domestic schools (China News, 2013). The government approved Suzhou-Singapore International School (SSIS) was once the only government sanctioned International school in SIP. For the first ten years student enrollment doubled every two years. In 2006, SSIS relocated to a large, state-of-the-art facility to handle the growing number of *expat* students. SIP now houses over 5 foreign-owned International schools. These schools offer Chinese parents a daily reminder of the accountability Western parents' demand of their schools and it is had an impact on local domestic education.

Chinese primary education is mandatory until grade 9. During the Cultural Revolution, maintaining rigid indoctrination in a primary school assured the political beliefs of adults later in life. With Deng's 1980s push to update the national education system, indoctrination was replaced with cronyism. Studies conducted in mainland China have rarely looked at students from the country's northwest areas, where technological and educational resources are limited, compared to the major cities of the coastal region (Jung, 2006, p. 5). But even in the coastal regions the quality of education provided in Chinese public schools is inconsistent and, unofficially, depends on the cash incentives the family is willing or able to provide. Beginning with grade 9, domestic students who can afford it choose between (1) remaining in the Chinese system, taking the *gaokao* upon graduation and entering a Chinese university or (2) entering an English-language program that prepares them for Western university study. The choice is irrevocable. Students who chose this English-language specialization may not, at a later date, return to the traditional domestic school program. These

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English-language programs are usually house in a wing of the traditional school campus but are conducted in English by native Chinese teachers. Often these programs are for-profit, joint-ventures between local administrators and private concerns many of whom are associated with Western university partners.

China has been slow to engage in joint ventures with the West. In response to parental demands to modernize educational systems, China sought a compatible Eastern education system that could maintain a modicum of curricular control while producing a 21st century workforce: it settled on Singapore. The Singaporean model, successful in reconstructing their ravaged educational system after the war years, was familiar to Chinese developers who wanted to a blend of Eastern fiscal conservatism and Western instructional progressiveness. Educational joint-ventures between these two countries have set a norm that China seems happy to follow when developing its home-grown International schools. In response to parent ability-to-pay, China's new two-track system is being tested in limited educational markets. These quasi-International schools allow the CMoE to develop its own brand of International schools housed on domestic campuses but offering English language coursework. It is hoped that this new dual-campus effort will be underwritten by the major educational expenditures Chinese parents make in P-12 education and will eventually offer a more equitable education to all regions of the country (Hewitt, 2008).

In the new Chinese International schools private partners provide teaching staff including English-speaking language teachers, visits to foreign countries and access to visiting university recruiters. To qualify for these specialty schools, students must have rudimentary English skills and their families must have more than sufficient funds to see the student through eight years of costly private high school and university programs. Due to demand, students enrolled in these targeted programs are assured placement in foreign universities by for-profit recruiters who handle all recruitment, visa and foreign settlement details for an average fee of $10,000USD per student (Ameson International, 2015). While the TOEFL and IELTS exams are sufficient measures of a student's basic language skills, passing grades do not indicate language abilities of the level required for a rigorous university program. Xueqin, Yale graduate and director of the international division of an elite Peking high school, is very candid about the business of student recruitment. "College recruiters in China feel overwhelmed by the proliferation of cheating, lying and fraud. Study abroad is a big business in China and young Ivy League graduates write essays for Chinese applications while many Chinese public schools fake transcripts and recommendation letter. Colleges use criteria that are easily fudged – SAT cram schools and ghost-written essays are fixtures throughout China. The file of many a Chinese applicant is a manufactured confection" (Xueqin, 2011, p. 3). At some top-ranked high schools, students with low admission test scores can "buy" a few crucial points that put them over the threshold for admission. According to an unwritten but widely known policy at one elite Beijing high school, students receive an extra point for each $4,800 their parents contribute to the school (Levin, 2012).

Many students board at Chinese International schools as daily transportation to and from schools is not provided nor it is feasible as many students travel considerable distances to attend the better schools. Students are free to go home Friday evening and are expected to return to school by dinner-time on Sunday. Students have an assigned desk in a single classroom and remain there all day while the teachers rotate from room to room. The daily teaching schedule is modelled on the traditional domestic school format. Eye muscle relaxation exercises were added in 2009 when the CMoE found that 85% of Chinese high school students suffered from myopia due to study habits (People's Daily Online, 2008). This teaching schedule indicates an academic emphasis on the social, biological and *hard* sciences required for passing the assessment tests that have become so prevalent in education. In 2015, it was announced that the traditional college placement exam in the PRC, the *gaokao,* would no longer include an English-language component in what is seen as an attempt to change cultural dependence on Western thought. Over 9.5 million students took the *gaokao* in 2015 (Lu & Whiteman, 2015, para. 2) Table 9 presents a common school day schedule (Mavrides & Hayes, 2012, p. 9).

Table 9: Peoples' Republic of China domestic senior middle school class schedule

Common Senior Middle School Class Schedule

	Monday	Tuesday	Wednesday	Thursday	Friday
8:00 - 8:40	Class Meeting	Chinese	Physics	Math	Math
8:50 - 9:30	Chinese	Biology	English	Chinese	P.E.
9:30 - 9:50			Morning Exercise		
9:50 - 10:30	Math	Math	Chemistry	History	Biology
10:40 - 11:20	English	Chemistry	Chinese	English	History
11:20 - 11:30			Eye Muscle Exercise		
11:30 - 12:10	Geography	English	Biology	Politics	Chemistry
12:10 - 2:00			Lunch		
2:00 - 2:40	Math	Elective	Math	Physics	English
2:50 - 3:30	Politics	Elective	P.E.	Biology	Chinese

Coursework in computer technology is not offered in the daily schedule nor are computers used in the general studies classrooms. Assignments are hand-written and submitted on paper. There is no Internet connectivity available on campuses and limited use of school computers for research purposes. Personal computers, tablets, laptops, etc. are not allowed on campus because the schools cannot assure adequate security for them. Use of mobile phones is limited to meal and evening free-time. Though this program produces students with rudimentary English-language skills they will not have ICT skills (Chen, 2009).

These schools are populated by students headed for foreign education but the majority of the coursework is taught by English speaking Chinese teachers. As a last vestige of Mao's teachings, Western educated teachers were not allowed full access in Chinese domestic schools until 2005, when the need for English-speaking teachers required that schools accept foreign nationals in their ranks on a larger scale. Many schools accepted commercial assistance from language schools that subcontracted English-language teaching services in specific subject areas. But the majority of the coursework was still taught by domestically trained, Chinese nationals (Ameson International, 2015). Short reports on the availability and satisfaction of these domestic teachers appear often in Chinese media as education is the most costly family expense after food. Male teachers are in short-supply and even the more dedicated leave the profession in high numbers. In 2012, Tian Yun, a 32-year-old native Chinese English teacher, taught in a well-established Hunan Province middle school. His salary was 2,000 ¥ per month (400AUD). He was criticized for playing English songs and films in class to improve students' spoken English. "The current school management and systems do not allow teachers to freely express ideas in a structure that prioritizes academic achievement as indicated by examination results", he said. Male teachers account for less than 20% of the city-school teaching population (Yan, S. 2012, p.6). It is a cross section of these national and International teachers that were contacted for the second survey of this research study: *SurveyP-12*. In lieu of asking students to analyze their ICT skills, *SurveyP-12* asked their teachers about the use of ICT in the classroom and the student skills acquired over the course of the domestic students' P-12 education.

3.3.3 Modern Chinese education - decision-makers

Three groups directly impact the Chinese students' P-12 education: the government, the family and the student. Though education is highly centralized, China has far too many primary and secondary schools for the national government to effectively police anything but the most sweeping initiatives. The day-to-day administrators are local and under their watch, traditional policies, procedures and curriculum do not changed quickly or easily. This traditional hierarchy maintains a minimum level of standards for core curriculum. The advent of computers brought national policies to the local level requiring changes in the daily school structure and challenging this long-standing division of power and responsibility. On the grand scale, the China Internet Network Information Center (CNNIC) is the administrative agency currently responsible for Internet affairs under the Ministry of Information

Industry of the People's Republic of China. It annually reports the statistics of Internet penetration across China. Western academic researchers often ground their arguments quoting CNNIC statistics, and then counter them by examining the more immediate issues faced by China's various ICT users: teachers, students, administrators and policy makers. (Hu & Webb, 2009; Ross, 2005; Sang, Valke, van Braak, Tondeur & Zhu, 2010; Zhao, Lu, Huang & Wang, 2010; Zhu, 2010 p. 73). These studies generally show that ICT integration remains subject to administrative and political forces and is hampered by a lack of integration curriculum, teacher training, infrastructure, Internet connectivity and the development of English-speaking teacher and student cohorts.

The CMoE goal is that some of China's best public schools, where the smartest and wealthiest students congregate, will one day become international in focus. To achieve this, China is developing Western bad habits as well as good. Like many nations in the West, China is now criticized for *teaching to the tests*. Under pressure of the selective educational system, schools are forced to use very exam-oriented teaching methods, as exam scores are important evaluation criteria for the students' further study (Zhu, 2010, p. 76). These exams have grown increasingly important in determining university placement so much of the daily work focuses on the rote memorization techniques needed to excel on them. China, like the West, is teaching-to-the-test, but which tests? Chinese educational ministers are currently experimenting with a two-track system—the traditional stream that prepares students for the gaokao, and a new one that prepares them for the Scholastic Aptitude Test (SAT) and the TOEFL (Xueqin, 2011, p. 2). Preparing for standardized testing takes priority over all other academic efforts. In Chinese schools computer- or Internet-related courses are not compulsory, and sometimes these courses are even cancelled or replaced by other courses, such as Chinese or mathematics for graduating students in junior and senior high schools (Zhao, Lu, Huang & Wang, 2011, p. 352). Min (personal communication, March 15, 2013) explained after grade 9 his son was never given a computer class. Any material our class time not related to testing material was commonly replaced by drills and practice that prepared him for standardized testing, such as the gaokao or the TOEFL.

It is difficult to characterize the Chinese parent who could afford foreign education for their child. China's checkered past created many opportunities for legal and illegal ventures. Events that were disastrous for one family were windfalls for another. Political upheaval caused the value and ownership of properties and possessions to change hands. Documents and accounts were lost or never recorded. Families saved and hoarded simply because there were no opportunities to buy necessary goods (Butterfield, 1982). Even today, many generations of one family live together pooling their savings. Domestic savings rates are hard to track as banks have yet to become universally acceptable institutions. Poverty is still a recent memory for most grandparents and education is seen as the most direct route for the family to guard against future financial ruin (Hewitt, 2008). Public policy dictates that education is free from preschool through grade nine. However, the demand for quality education has made public education a private, almost black-market business. For the majority of families in China, educational costs can represent up to 60% of their annual household income (Mavrides & Hayes, 2012. p. 3). Preschool slots attached to some prestigious universities are traded and swapped in a scheme almost akin to the stock market. Reports are common that parents pay for front row seats for their children or positions as class monitors. Parents are expected to provide valuable gifts or deposit money into bank accounts to assure their child receives common considerations (Levin, 2012). These claims are corroborated by recent research but it is difficult to prove as government policies label these for-profit exchanges as crimes. However, Min agrees with the researchers: such bribery is both common and accepted currently in China. Having lived in America with Western expectations of public education, his wife was incensed when she found out that on their first Teacher Appreciation Day she would be expected to make a donation in excess of $1,000 to her daughter's primary teacher. The money was paid and the costs have continued to escalate as their children have grown (Levin, 2012). Such accusations have persisted in domestic school regardless of government efforts to eradicate the practice.

3.4 International schools and teachers

The exponential growth of English-language based International education for all age groups has spurred the demand for English-speaking teachers: trained in every country and with both recognized and non-recognized accreditations.

3.4.1 International schools - the business of education

International schools originated to serve the children of military and diplomatic travelers. They were usually nationalistic, often located in secure compounds and provided a level of education that assured a graduate could return to their home country and fit within the domestic curriculum (CIS, 2015). As the number of expatriate commercial travelers moving with families increased, these diplomatic International schools served as prototypes for the current multi-national curriculum schools educating both foreign and domestic students located on most major cities around the world. What makes a school International is debatable. Is it the curriculum, the student body, the teaching staff – or a combination of all of the above? Most seasoned International educators are wary of coming up with a definition, but prefer to take a broad approach (Nagrath, 2011, p. 3).

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Professionals in International Education (PIE) is an online media, reporting and consultancy platform that represents and reports on all facets of International education. PIE notes that two-thirds of International schools are now run for profit, up from almost none 30 years ago and that many future International schools will be run by local or regional firms who seek a profitable opportunity. The International Schools Consultancy Group (ISC) believes that “Within 10 years, there will be over 11,000 International schools teaching 6.3 million students”. ISC concedes that this number could effectively double by 2024, to 14,407 schools (Keeling, 2015, p. 81). Focusing on Asia, some watchers cite globalization as the cause of the surge in demand for English language schooling in countries such as the RSK. The demand comes from all student levels: community and private schools, dedicated English schools, universities and businesses. In the RSK, though, the largest demand is from ‘Hagwons', English schools catering for young students. In Japan, ‘Eikaiwas', English communication schools, are commonplace.

These statistics may help understand the scope of the global, and more specifically the Asian, desire to learn English that is fueling the increase in English-speaking International teachers and institutions.

- An estimated 250,000 native English speakers work as English teachers abroad in more than 40,000 schools and language institutes around the world.
- Eighty percent of English teachers abroad in non-native English speaking countries – particularly in public schools – are not native English speakers themselves because there are simply not enough native English speaking teachers to meet demand.
- Seoul and Shanghai that have over 10 million people and are home to 1,000 language schools employing up to 15,000 foreign English teachers.
- In only one country, the Republic of South Korea, an estimated 24,000 native English-speakers are employed.
- In both China and South Korea, approximately 1,000 new English teachers are hired each month. In China, this number will double in the coming years (International TEFL Academy, 2015, p. 2).

International schools in Southeast Asia face nationally-imposed restrictions.

- PRC pupils without foreign passports are barred from International schools.
- Singaporean citizens require government permission to attend International schools. This dispensation is rarely granted unless they have lived abroad.
- In the Republic of South Korea a maximum of 30% of an International school’s pupils can be locals (The Economist, 2014).

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With the increase in the number of PRC students applying each year to Western universities, China-watchers are always alert to any hint of liberalization. Since 2001, foreign groups and individuals have been allowed to own schools in partnership with Chinese owners, and since 2003, schools can be run for profit—but only authorized International schools may teach foreign curriculum. Education is the last bastion of the Mao years. The government fears losing control over what children are taught. China has 2.5million 'dollar millionaires", many of whom would pounce at International schooling for their offspring if they were allowed to. It is not uncommon for parents to renounce their children's' PRC citizenship simply for education purposes, a trend that has the Chinese government speeding up the dual-campus, domestic-International school option. Officials also argue that without strict rules Chinese parents could be gulled by greedy foreigners (The Economist, 2014). In many cases, a difference in cost does not directly indicate a corresponding difference in the quality of the education provided. It becomes the responsibility of the parents to oversee their child's educational experience and to monitor the curriculum of their local schools. In the global context, International education has become *Caveat Emptor:* let the buyer beware.

One profitable option open to Chinese domestic schools is to subcontract English-language International program providers such as Ameson International, a Chinese-American joint venture. Their programs train students as young as 12 for (guaranteed) American university enrolments. Ameson controls all aspects of the instruction, testing and recruitment process: IELTS test score, admissions testing, completion of admission documents and supporting academic essays (Ameson, 2015, p. 1). Another group similar to Ameson is Dipont Education; a Chinese-owned firm that grew out of an Australian concern that helped Chinese students arrange foreign study trips and apply for visas. Implying affiliation with Western institutions is a profitable vehicle for attracting upwardly-mobile Chinese parents to pay as much as $42,000 per year tuition. Oxford International Colleges of China have no British affiliations. Eton House is Singaporean-owned and Maple Leaf Education is sanctioned by the British-Columbia Ministry of Education. Each has schools in a number of Chinese cities (Hornby, 2013, p. 2). Dipont subcontracts teaching A-levels, AP courses and the International Baccalaureate to 6,000 15- to 18-year-olds in 27 Chinese schools in 17 cities yet adheres to the accepted practices of Chinese recruitment into Western universities (Keeling, 2015, p. 83). For example, in 2015, English-language testing, scoring and validation subcontractors were called to question in the United Kingdom and over 45,000 student visas were reviewed, suspected of fraudulent documentation (Smith, B., 2014, p.1). Foreign student visas have historically been a political issue. In 2001, 16 vice-chancellors of UK universities expressed their 'profound concern' over government plans to limit severely the number of foreign student visas. At that time 20% of the degrees awarded were to foreign student from outside the EU (Waters & Brooks, 2011, P. 155).

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3.4.1 International schools - teaching English without ICT

Chinese students are trained to read Chinese like they're taking a walk in the woods, as a free spontaneous and emotional experience. For example: the word 'lily' in English is four phonetic letters and to a native speaker calls to mind a long-stemmed white convoluted flower from a moist climate. In a pictorial language a 'lily' may be, in Western terms, represented by line art that shows a convoluted, aromatic, water flower that opens in the early spring and is the color of death. This is appropriate for reading Chinese but not for reading English which demands a more structured approach. Traditional Chinese curriculum does not teach concepts such as thesis, logic, support, evidence and structure and the traditional remedial-English curriculum is not going to help them much. They are going to need remedial courses tailored to the Chinese mind that change the way they think (Xueqin, 2011, p. 5).

Before coming to university, foreign students will complete many years of English-language preparatory courses usually within their home country. To these students, multimedia and other ICT would offers options that help bridge the gap between these disparate languages. However, it is unusual for these programs to use even rudimentary ICT for language learning. Also to be considered are linguistic, social and learning-style factors. Among these, linguistic factors play the most significant part in determining the success of their academic as well as social and emotional wellbeing. A lack of sufficient language skills will impact staff-students interaction, peer-cooperation and intercultural acculturation (Lu & Short, 2012. p. 1).

"Both English and ICT have become essential literacy skills… that ensure full participation in the information society" (Chauhan et al., 2013, p. 406). For-profit International schools should be expected to invest in learning technology and the teacher training, infrastructure and educational materials required to support ICT in accordance with their Western counterparts. A combination of the need for ICT skills and lack of interest in the P-12 schools is responsible for the Academic ICT Gap. Supporting English 2nd language learning with self-taught ICT on personal computers or in Internet cafes is not an option. Students who develop *fast-fingering* using social media in everyday life are optimistic about their skill levels. When surveyed, many commencing students rank their ICT abilities as adequate and above. However, research shows that self-assessment of ICT skills is rarely accurate with most individuals, students and teachers, overestimating their ICT abilities (Jung, 2009, p. 43). As best this home-spun approach to ICT integration in developing countries is a stop-gap action and will not produce the next digitally-enabled global workforce.

It is only when the student arrives at university that they realize that they do not have ICT skills commensurate with their Western counterparts. It is not easy to self-teach nor can they be acquired by random computer use. They are mandatory for higher education and for post-graduate careers, especially for the student preparing to enter the global, multi-lingual arena. ICT skills are a measure of professionalism and foreign students are expected to have attained proficiency in them before attending Western universities (Bhatnagar - India, 2013, p. 117; Caruso & Salaway, 2008, p. 2; Chauhan et al.-PRC, 2013, p. 406; De Wit et al., 2011, p. 205; Elwood & MacLean - Japan, 2009, p. 66; McGowan & Potter - China/PRC, 2008, p. 183; Mokhtar & Majid - Singapore, 2008, p. 28; Molnar, 1973, p. 3; Oliver & Towers - Australia, 2000, p. 381; Peerear & Petegem - Vietnam, 2011, p. 974; Pellicone, 2001, p. 2; and, Venables, Miliszewska & Tan, 2012, p. 1).

3.4.2 International teachers - representatives of all things Western

Different types of teacher certifications and qualifications are required at each International school. Some schools are also restricted by government regulations. For example, Thailand has a very strict definition for the combination of university courses that a teacher must present to be nationally-recognized and qualify for a full work permit. TeachAway (2015) a professional International teacher recruitment agency, lists the following classifications for International schools:

- American, Canadian, Australian and British International schools offering national curriculums in English
- International Baccalaureate (IB) Curriculum P-12 schools
- Crossover IB schools that blend local and IB curriculum
- International General Certificate of Secondary Education (IGCSE) schools
- Foreign/Domestic Curriculum P-12 schools
- International Schools unregulated incorporation of multiple curriculums
- Private language schools and institutes are prominent in Asia
- Private English as a Second Language (ESL) tutoring service.

To work in the first four school groups, a domestic teaching certification with a university bachelor's degree is required. In many countries, granting a teaching visa requires an additional two years of teaching experience. However, to work in the private language schools and conduct private language tutoring requires less certification (TeachAway, 2015, p. 1-8).

Meeting the global demand for English-teachers has challenged the certification and qualification processes required in most Western schools and the type of teacher-candidate is changing accordingly. Whereas Teaching English as a Foreign Language (TEFL) applicant were once largely new graduates looking for experience and adventure for a year, applications from people with experience in various sectors of the job market are now turning to TEFL. English speakers from a variety of non-English backgrounds are earning TEFL and Teaching English to Speakers of Other Languages (TESOL) certification in order to enter the Asian educational systems. Teacher recruitment companies now state that applications to teach English abroad are coming from those with experience in the financial sector and even the service sector within the UK (Davies-Rommetveit, 2014, p. 2).

3.5 Assessing the Academic ICT Gap

3.5.1 Development of ICT skill assessment for all stakeholders

The need for learners of all ages to acquire 21st Century Skills has driven the development of ICT assessment tools for and by business and academia since the late 1980's (Ananiadou & Claro, 2009; Bell, Andrea & Lambert, 2010; Dede, 2010a & 2010b; Griffin, McGaw & Care, 2012; and, McComas, 2014). In the beginning the simultaneous introduction of computers into education and commerce meant that adults and school-aged students were learning many of the same skillsets. Given the wide range of uses for ICT, defining 21st Century skills was surprisingly consistent among the major educational organizations such P21, the OECD, ISTE, AACU and ETS. "Groups developing conceptualizations of 21st century skills have built sufficiently on each other's ideas to avoid a 'Tower of Babel' situation… Organizations that argue for 21st century skills have frameworks largely consistent in what should be added to the curriculum" (Dede, 2010a, p. 76). But now, how does one assess?

This study identifies the primary features of the Academic ICT Gap and its effect on modern Western university performance. In response to *SurveyHE*, 353 Australian university instructors ranked the importance of a select group of ICT items to their course completion. *SurveyP-12* asked 135 pre-tertiary International teachers from countries other than Australia to indicate which of these ICT items their student would master in their coursework. A comparison of the surveys' data identified discrepancies in high-level research and data management skills required for academic-level submissions.

In 1998, ISTE published an introductory series of technology standards for students which were quickly adopted and field-tested in public schools in the USA. By 2009, ISTE had reissued rigorous standards that proposed a comprehensive, attainable program with ICT items scaffolding for students, instructors and administrators. Unfortunately, such guidelines are difficult to apply to all stakeholders. Schools may require training of students and teachers. But administrators and other executive, who would benefit from such training in their decision-making processes, are often overlooked or included only on a voluntary basis. Oliver and Towers noted in 2000 (p. 382) that the term *computer literacy* was being replaced by *ICT literacy*, a broader term that included emerging dimensions of technology brought about by networks and the Internet. They reported that a version of ICT literacy had existed for a number of years and was defined as the skills and knowledge needed by a citizen to survive and thrive in a society that is dependent on technology for handling information and solving complex problems (Hunter, 1984, p. 45 as cited in Oliver & Towers, pg. 382). To excuse the development of necessary ICT skills in a select group of decision-makers is counter-productive and does a disservice to the life-long learning construct that is often a stated goal of ICT programs across all institutions. The ISTE standards reflect the lofty goals of higher education tempered with the practical considerations of a productive workforce. On the one hand, this delicate balance maintains the importance of knowledge 'as an end in itself', critical thinking and independent thought; however, it also emphasizes that universities should instill the skills necessary for students to become members of a highly productive and professional labour force. While the two ideals are not mutually exclusive, they present a distinctive challenge to the higher education sector (Kearney, 2012, p. 876).

Since 2004, UNESCO's EDUCause Center for Analysis and Research (ECAR) has monitored the integration achieved by developed and developing countries. Their annual ECAR Report comparing achievements has proved a highly credible resource for decision-makers around the world (Caruso, 2004). In Bangkok, EDUsummIT 2015 met and one area of continuing examination was the digital divide in Asian P-12 education. Working Group 4:Addressing Gaps and Promoting Educational Equity issued a draft discussion paper after the event in which they emphasized the need for "built-in systemic and synchronous top-down and bottom-up processes that will assure sustainability" (Laferriere et al., 2015, p. 3.) Like ISTE, this white-paper supports ICT skills for all. By selectively including the terms "top-down and bottom-up" this document emphasizes the need for all stakeholders to accept ICT training in order to achieve sustainability. (See Appendix 4: EDUsummIT Working group 4 Digital Inequity)

Intervention into the ICT teachings of global P-12 education is not an easy task. Organizations such as UNESCO continue to make concerted in-roads by influencing and educating academic decision-makers to develop an overall vision that combines the interests of parents, students, political and commercial groups. Everyone agrees that a high-level of ICT efficiency will be required in the workplace of the future but there is no agreement on how to achieve this performance level. This research suggests both an immediate and a long-range approach. Immediately, universities, either alone or together, must create a substantive Academic ICT Baseline that lists the ICT and RPS skills required for higher education. From this information, long-range planning can begin at the P-12 level to train students with the Academic ICT Baseline skills. The provenance of the Academic ICT Baseline means that sound decisions, such as infrastructure investments and professional development of P-12 educators, can be made with confidence. The assessment process required to maintain a current, university-driven Academic ICT Baseline would be ongoing, allowing for modifications at the P-12 level as warranted. The *SurveyHE* data that underpins this research provides the research to begin development of a generic yet comprehensive university Academic ICT Baseline. Achieving the development of this baseline would make a marked difference in the cohesion of ICT instructional development in the international sphere. The Academic ICT Baseline also would reflect the best-practices ICT required for industry and commercial concerns.

3.5.2 Development of Instructional Systems Designed for ICT skills delivery

Instructional Systems Design (ISD) is the process of constructing the content and application of an effective knowledge delivery vehicle. The term originated in World War Two in relation to successful military training methods. From the 1950's through the 1970's ISD was tested and modified in educational curriculum. Bloom's taxonomy, published in 1954, was compatible with ISD for education. Figure 3 depicts the hierarchy of the thought processes included in the early renditions of Bloom's Taxonomy.

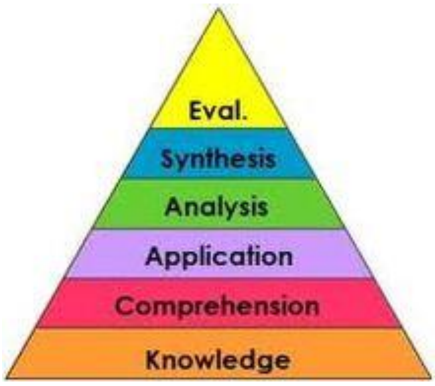

Figure 3: Bloom's Taxonomy: Hierarchy of Thought processes

ISD was not widely used in education until the 1990's when influenced by constructivist theory. Constructivists believe that learning experiences should be "authentic" and produce real-world learning environments that allow the learner to construct their own knowledge from personal experience. This emphasis on the learner was a significant departure away from traditional forms of instructional design (instructionaldesigncentral, 2012). Computer technology is well-suited for ISD in education. Instructional designers are the architects of the knowledge to be acquired by the learners, determining the blueprint, or the design types and delivery. While the learners bring their own needs, experiences and tools to a learning situation, instructional designers must incorporate those needs and experiences into instructional strategies, helping learners take ownership and responsibility for their own learning (Tripp, 1992, p. 8). Foreign student may share only a few common needs and experiences with their Western peers so designing a one-size-fits-all remediation program based on Western learning assumptions becomes challenging. ISD is a systematic process that identifies skills to be learned, conditions under which the skills must be performed and the criteria for successful performance. Implementation includes the delivery methods of the instruction. Assessment and evaluation of effective instructional design focuses not only on the instructional goals, learners and the context in which they learn, but the adequacy of the instruction and the entire ISD process (Dick, Carey & Carey, 2005, p. 15).

3.5.3 The Importance of processes in closing the Academic ICT Gap

Process is a much used and frequently misused term in education. For the purpose of this paper, process is not interchangeable with systems, procedures and structure. Education can be represented as the transformation process that converts prospective learners (inputs) into learners with defined learning outcomes (outputs). Simply stated, processes are the activities and tasks that are carried out to produce learning. It is not possible to improve learning outcomes without enhancing the learning processes by which such outcomes are achieved. All learning processes can be planned managed and improved using well-tested strategies and techniques (Cox, 2002, p. 7).

The core processes in designing effective curriculum include developing a comprehensive lesson structure through task analysis, inducting the learner into the program, diagnosing each learner's styles, facilitating learning by incorporating effective strategies, assessing and verifying learning and comprehension and providing guidance and support. When rooted in the core processes, instruction does not cause learning but supports learning intentions to which the learner commits. An effective and complete instructional design will include all of these processes whilst maintaining the flexibility to modify all processes as indicated during regular assessment and verifying stages. Though often difficult to measure, the lack of process flexibility is the most common cause of learner dissatisfaction. Process flexibility may be evidenced by the extent of non-standard procedures incorporated into the instructional design outcome (Lohr, 2004, p. 2).

In *Handbook of Task Analysis Procedures*, Jonassen, Tessmer and Hannum (1999) categorize task analysis into five domains; procedural analysis, cognitive analysis, learning analysis, content analysis and activity analysis. Figure 4 below illustrates the five domains of task analysis (p. 6).

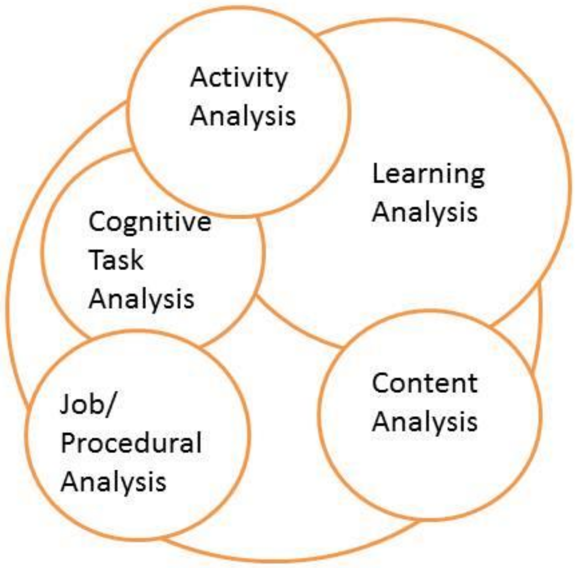

Figure 4: Illustrates the 5 Domains of Task Analysis

Job/procedural analysis is used extensively in commerce and industry but less often in education as it addresses those instructional components that require sequential overt performance. The remaining analyses pertain to all forms of ISD. The instructional designer selects individuals to perform the task, develops an outline from observing the task performers and revises the outline as needed based upon continued observation of the task performers.

1. Cognitive task analysis focuses on the learner and the internal knowledge conditions of the learner. The instructional designer is concerned with a description of actions in which performers engage that are associated with knowledge conditions that are necessary to perform a task. A task is identified as cognitive if it is purely intellectual.
2. Learning analysis identifies prerequisite skills in an order of hierarchical relationship. The lowest skill documented must be mastered before introducing higher-level skills. For the instructional designer this applies to both physical and cognitive skills (Hallamon, 2001, p. 10).
3. Content analysis investigates the inferences and hidden meanings in text and curriculum that may be a subjective influence on the student's learning process (Stemler, 2001, p. 2). At all times the instructional designer must be aware of including positive and progressively more complicated content at all levels of their curriculum design.
4. Activity analysis is a hybrid of cognitive, learner, content and procedural task analysis. The activity must be analyzed in the natural setting. Conscious thinking and activity are not

> separable. Instructional design needs to take into account the context in which learning and performance occurs. (Tessmer & Richey, 1997, p. 87).

Self-regulated learning occurs from the influence of the student's self-generated thoughts, feelings, strategies and behaviors, which are oriented toward the attainment of goals (Zimmerman, 2002, p. 65). Self-regulated learning strategies are defined as actions and processes reinforcing the acquisition of information or skills of direct and personal interest and value to the learner. Selecting strategies involve identifying appropriate strategies among cognitive, motivational and environmental strategies (Ertmer & Newby, 1996, p. 5).

Students moving from Eastern to Western learning systems have the greatest need for clear goals and expectations. An example of ISD suited to teaching the ICT items dictated by the Academic ICT Baseline in a multicultural classroom is *Project IF: Ideas for the Future*. This bespoke curriculum is focused on applying real-world digital performance skills to developing team-building and relationship roles that are only partially based on English-language skills. *Project IF* combines responsibility exercises and interactions between disparate individuals who assume specific roles and responsibilities as dictated by their personal interests. The primary goal is the creation of a well-conceived multimedia project that builds on personal experiences by combining students with diverse learning styles into small interactive teams that require individual contributions and interpersonal interaction. Students choose their initial role or responsibility from three predefined areas: promotion, management and production. All roles heavily stress the ICT items of the group and all final production pieces are group collaborations (Price, 2005). Students with verbal/linguistic learning style will adapt easier to the roles based on traditional Western learning styles. However, multimedia and online applications provide enriched formats for non-native students to adopt roles that allow them to translate and share their diverse experiences with their teams. It is vital that policy makers and program developers are flexible in the program and syllabus of English language courses in order to take multiple intelligences of foreign students into account (Abbasian & Khajavi, 2012, p. 127). In addition to instructional design based on Gardner's multiple intelligences, *Project IF* also develops the self-regulated learner. Multicultural students expect regular assessment and performance-based feedback by which they modify their achievement levels. Assessment is the completion of a project-based collaboration that creates a problem-solving product and using multimedia to present a finished digital prototype.

Students trained in Eastern educational systems may also require help in adjusting to the Western instructor's role in the learning process. Eastern systems hold that; the instructor is the master of the knowledge domain, the role of the student is to remain silent and to obey the instructor, there is value in receiving information and recording what is received, information received will ultimately appear as items on tests and those who get high test scores will receive favor. Consequently, when an instructor presents a problem to be solved and instructs the student to use the computer to seek the answer, the instructor has relinquished the role of master of content. “Teachers are role models for us. We do what they tell us, and we hardly ever become disoriented.” (Ku, et al., 2004, p. 89). This change in the instructor’s perceived role is countered by strategies that underpin *Project IF* such as peer interaction and assessment, group project work, and regular instructor evaluation of computer-based work. Effective instructor evaluation should be specific and directly related to the task, evaluation criteria should be made explicit to the students before they begin working on the learning task, and students should be provided with opportunities to revise their work after it is evaluated (Olina, 2002, p. 63).

The Academic ICT Gap may be responsible for a range of issues that are holding back progress in digital education. “The deficiency is not confined to undergraduates. A study published in 2009 in the journal Current Issues in Education found that a group of 97 American masters and doctoral students did no better in an online diagnostic writing test than the typical college-bound high school senior” (as cited in Kperogi, 2013, para. 9). If advanced-degree graduates experience the Academic ICT Gap then it is possible that within universities and due to global staff mobility we are reintroducing The Gap to successive generations. International teaching and research staff embody a range of experiences and expertise developed in diverse academic contexts (Grimshaw, 2011, p. 710). If these experiences do not include countering the Academic ICT Gap then, like a computer virus, each succeeding generation is re-infected.

3.6 Chapter summary

The 15-year-old Chinese student who, in grade 9 enrolls in a PRC English-curriculum domestic school program and commits to pursue Western higher education, accepts the challenge of years of learning rigorous academic content in a non-native, non-pictorial language. In addition to preparatory courses in Chinese, science, math, and the social sciences she/he is cramming for standardized English language testing. She/he is assured every day by teachers and parents that she/he is being adequately prepared for foreign university. When she/he finally passes their TOEFL, IELTS or SAT language test and is accepted into a Western university she/he truly believes that she/he has achieved a considerable portion of the collective family goal. She/he has prepared her/himself according to the advice of all of the adults and is ready to take an active part in Western higher education. However, the reality of Western universities is fraught with challenges for which the student is not prepared (Yan & Berliner, 2011, p. 182). In China, few students can imagine the magnitude of difficulties they will encounter in the West. They are shocked by the unexpected nature of the difficulties and their inability to effectively deal with them. Of the myriad assimilation issues these students face, this research calls attention to the most overlooked and, possibly, easiest to address challenge: the importance and the use of ICT in Western higher education.

"The elephant in the (chat) room is that most International students pay exorbitant fees, undergo complex administration processes, live in austere conditions and satisfy local business demand for poorly regulated informal labour in the dream of a better life. Both the needs of students and providers demand critical thought in debating the future of education" (Birtchnell, 2012, p. 3). Universities enter into a tacit contract with the foreign student, officiated by signing an acceptance agreement and upon deposit of tuition funds. This agreement has an implied moral component and it is the upholding of this moral responsibility that may set one institution apart from others. Australian universities make sweeping promises but it is the educators, as the daily representatives of the institution, who incur responsibility for upholding the institution's promises. Universities conduct coursework in English and the use of ICT to deliver this coursework throughout the university system is endemic. Two ICT areas need immediate attention: ICT training to allow the foreign students to formally express their acquired knowledge in a general Western context; and, RPS which include L/CMS training to allow student seamless access to the growing amount of required online course content and to conduct faculty and curriculum-specific learning. Commencing foreign students need real-world ICT skills assessment targeted to specific study areas. This is the educational/commercial goal foreign students expect to achieve at Western universities.

Many academic studies of student ICT skills, important in their own right, have concluded that conducting computer skills assessment is a highly valuable recruitment and placement instrument. However, this important tool has not been widely employed. "Perhaps surprisingly, little empirical research has been published on students' general use of technology in the context of Australian higher education (Kennedy, Judd, Churchward, Gray & Krause, 2008, p. 109). In 2009, Ellis and Newton conducted a survey with 1,065 Australian student respondents which came closest to this researcher's field of interest. They believed that "there is little empirical evidence documenting the technology-related uses, experience, expectations, skill levels and training needs of the broad range of students currently entering Australian Universities". They summarized by agreeing with other researchers in recommending that a long-term survey instrument be developed and applied on a regular basis (p. 24-25). The following studies also recommend that additional research to be conducted, most commonly in the form of an assessment tool designed initially to benchmark student skills and then to track changes in their ICT abilities: Albion et al.-Australia, 2010, p. 7;

The Academic ICT Gap

Bhatnagar-India, 2013, p. 120; Crisp et al.-Australia, 2009, p. 24; Jones, C., et al.-Multinational, 2010, p. 732; Li & Ranieri-PRC, 2010, p. 1040; Li & Walsh-PRC, 2010, p. 115; Margaryan et al.-UK, 2011, p. 439; Oliver & Towers-Australia, 2000, p.11; Peeraer & Petegem-Vietnam, 2011, p. 7; Thang et al.-Malaysia, 2014, p. 189; Verhoeven et al.-Belgium, 2010, p. 64 & 2011, p. 229; Waycott et al.-Australia, 2010, p. 1210; and, Zhao et al., 2010. p. 1422 & 2011, p. 352. By recommending additional attention be given to these various skillsets, these researchers recognize that the quantitative survey is not a valid substitute for a targeted assessment tool. Most of these researchers contend that, in general, an Academic ICT Gap will be indicated and that systemic remediation would improve the outcomes for all academic stakeholders. Universities should assess their own ICT use and develop an Academic ICT Baseline relevant to the needs of their campus. By issuing a transparent document, P-12 educators can develop curriculum appropriate to meet these needs. Students can be trained to better understand and prepare for their university experience.

4 METHODS THAT MEASURE THE GAP

'Cheshire Puss, would you tell me, please, which way I ought to go from here?'

'That depends a good deal on where you want to get to,' said the Cat.

(Alice in Wonderland, Lewis Carroll, 1865, Ch. 5)

This chapter explains the methodological decision-making process determined most applicable to resolve the research questions of this study. The primary goal of this research was to determine if an Academic ICT Gap exists between the skills required by Western tertiary educators and the skills brought to these institutions by their commencing foreign students. The choice of analytical methods was data driven. No one method provided the range of analyses that was ideal for the data gathering and study contexts. Grounded theory presented guidelines for similar analyses: recognizing *memoing*, emails and blogs, creative groupings, etc. But this study was not making observations with the intention of discovering and grounding a theory. Instead it was testing a theory born of observations and experience in fieldwork and teaching in Arlington, Texas; Edinburgh, Scotland; Suzhou, China; and Launceston, Tasmania. Because this research would be introducing new knowledge in a controversial field the analyses needed to be convincing and comprehensive yet simple, easy to recreate and sensitive to detecting emerging ICT phenomenology.

4.1 Survey components

This study examined the academic relationship between two cohorts: *the commencing foreign students*, and *the Western university instructors*. This study required purpose-designed surveys with content that included traditional office ICT as well as online and emerging digital applications. Quantitative and qualitative data were gathered from two targeted groups: each representing a larger, diverse population. ICT are *objective* and can be easily itemized. The educator's choice to use a specific ICT is *subjective*. As very few research methods are mutually exclusive, a combination of data analyses was required. Together, these analyses would provide stakeholders: from government and political figures to curriculum designers; with an Academic ICT Baseline of timely data upon which to confidently base ICT decisions and begin to close the Digital ICT Gap.

4.1.1 The commencing foreign student

Research question 1 asks: *What are the ICT skills of a non-Western-educated P-12 student.*
To represent the foreign, non-native-English speaking student, I considered surveying commencing foreign students at a Western university. This option was rejected as it presented three challenges: I

would need o access a substantial number of commencing foreign students; the language issues would make exact translations of their responses difficult to verify; and, the students' first-year assimilation and adaptation issues would likely contaminate the efficacy of their responses. Established research also indicated that student's self-assessment of their own ICT skills consistently results in highly speculative data (Li & Ranieri, 2010, p. 139). In their stead, I chose to survey the foreign students' preparatory teachers: the secondary and English language International teachers working in non-Western schools. The challenges posed by choosing this cohort were manageable within the scope of this research study.

4.1.2 The ICT required by Western university instructors

Research question 2 asks: *What digital ICT skills are required to undertake a Western university program.*

The ideal resource for collecting Western higher education ICT data was Australia. Australia's unique features: geographical location, multicultural and multilingual population and the country's political positioning in the Asian region, recommended surveying Australian institutions as a valuable reflection of Asian student migration issues. Though it is geographically located in Asia, Australia is similar to Canada, New Zealand, the UK and the USA in offering quasi-national curriculum in English. Each of these countries began integrating ICT into education in similar fashion and on similar timelines. All five countries offer similar theoretical and philosophical content based on their shared Greco-Roman liberal arts tradition. Academically, the position of the Australian government with regards to higher education aligns with the current international trends that focus on authentic and sustainable assessment that have relevance beyond the classroom (Kearney, 2012, p. 876). These goals are supported by stakeholders with the hope of developing a sustainable global workforce, experienced in commercially-viable ICT skills. In 2009 the Australian government stated these goals: self-fulfillment, personal development and the pursuit of knowledge as an end in itself; the provision of skills of critical analysis and independent thought to support full participation in a civil society; the preparation of leaders for diverse, global environments; and support for a highly productive and professional labour force should be key features of Australian higher education (ibid, p. 876). The number of university systems in Australia was a final consideration. New Zealand has 8 universities, too few for this study. Canada has 80 public universities; the UK has over 150 universities; and, the USA lists over 5,000 post-secondary institutions. By comparison, Australia has 40 accredited universities and by surveying 12 systems I would achieve 30% national representation (DEEWR, 2013). Australia provided a microcosm in which I could survey the highest percentage of a Western country's total public higher education network.

4.2 Survey data: Collection methods

Ethical approval of the research project, methods and correspondence was applied for and granted in May 2012 by the University of Tasmania Social Science Human Research Ethics Committee (HREC) #H12538. Each Australian university system chosen had over 32% commencing foreign student enrollments in 2013. The *SurveyHE* invitations were issued in Semester One of 2013 which in the Southern Hemisphere occurs from February through June. Table 10 shows the 2013 commencing student numbers, the calendar dates for the beginning of Semester One in each university system and is sorted by the percentage of foreign students and (DEEWR, 2013).

Table 10: Australian university calendar and enrolments 2013

University System	Total Commence	Foreign Students	Foreign Student %	Sem. 1 2013
RMIT University	19,615	10,493	**53.5%**	4-Mar
Bond University	3,465	1,843	**53.2%**	14-Jan
University of Ballarat	5,198	2,628	**50.6%**	25-Feb
Curtin University of Technology	17,579	7,508	**42.7%**	4-Mar
Macquarie University	14,361	5,911	**41.2%**	25-Feb
Swinburne University of Technology	9,146	3,610	**39.5%**	4-Mar
Monash University	21,904	8,118	**37.1%**	4-Mar
University of Technology, Sydney	12,576	4,361	**34.7%**	25-Feb
University of New South Wales	19,463	6,700	**34.4%**	4-Mar
James Cook University	7,677	2,577	**33.6%**	25-Feb
University of South Australia	12,818	4,270	**33.3%**	4-Mar
Australian National University	7,256	2,325	**32.0%**	18-Feb

(DEEWR, 2013)

Using basic cut & paste transfer, panels of email addresses from each university's publically-available website were constructed. These panels were imported to Qualtrics Survey Software© and online invitations were issued. As per HREC requirements respondents were given opportunities to decline participation both in the initial emails and online. Upon logging into the invitation Qualtrics Survey Software© assigned each respondent a random ID after which their individual details were only available to survey administrators. Potential respondents who did not enter the system within 14 days were automatically issued a reminder. After 30-days of non-participation, the survey deleted the unresponsive panelists and all their personal details.

Survey distribution benefitted from emerging ICT in one challenging area. Digital translation technology has made it possible to create a survey in one language and deliver it to respondents in their native language. Here the original survey content was issued in both English and Chinese. However, Qualtrics Survey Software© used Google Translate© to deliver survey content to respondents in languages other than English. For example, if a potential respondent accessed the invitation using a computer with a default server-setting of The Netherlands, the option to continue in either English or in Dutch was provided. This global accommodation meant that not only the languages of the survey but the design and content need not change to adapt to international users.

After closing the survey, the data was downloaded into the IBM Statistical Program for Social Sciences© (SPSS) and readied for individual and then dual analyses. After cataloguing response frequencies all personal identifiers, emails, ID numbers and university affiliation information were deleted and only data pertaining to the survey questions retained. The emails of respondents who indicated their wish to be contacted for a follow-up interview were segmented out and they were contacted individually to arrange further contacts. Again, these individuals were allowed opportunities to remove themselves from the process and some took advantage of this provision. (See Appendix 5: *SurveyHE* interview outline sample)

4.3 Survey design elements

4.3.1 Developing academic content for both the *surveys*

Survey questions 1-17 requested demographic data: age, gender, personal and professional ICT experience and professional qualifications. These questions provided qualifiers that would later allow for data analysis of various subgroups. Similar demographic question content has been used in ICT surveys conducted by other researchers (Bhatnagar, 2013; Elwood & MacLean, 2009; Li & Ranieri, 2010; Peerear & Petegem, 2011; Sang, Valcke, van Braak, Tondeur & Zhu, 2010; Zhu, 2010).

Questions 18-28 on the *SurveyHE* were unique in that they listed 65 ICT items grouped by skillset and asked the university respondents to rank the importance of each ICT item in relation to the completion of coursework in their field of study. These items were derived from curriculum standards and educational resources set by Western professional and governmental administrators. Resources consulted include:

1. Texas Essential Knowledge and Skills (TEKS) instituted in 2000 and with content continuously updated to reflect changes in technology and in learning and teaching best practices. Update 2011 was used for this study.
2. New South Wales School Connections: Using ICT to Engage Students in Learning. Content reflects Stage 4 (grades 7-9) technology requirements. (BOSTES, 2013).
3. International Society for Technology in Education (ISTE) Standards for Students first introduced c. 2000 and updated on a continuing basis.
4. UK Key Skills: Briefing on Key Skills in Higher Education, (Murphy, 2001). Key Skills are a shared curriculum standard in the UK and are updated on a consistent basis.

5. European Computer Driving License (ECDL) is a compilation of theory and practical application of computer skills targeted to adult and professionals but increasing being referenced by universities as an assessment tool (Ratiu & David, 2007).

For the purposes of this study, 28 ICT items were selected for inclusion in the *SurveyP-12*. These 28 items included the basic ICT skillsets required to complete a Western curriculum at the middle school level of grades 6 through grade 9 in accordance with the Australian, EU, UK and USA curriculum standards noted above.

To better analyze educators' preferences and how these preferences might influence their instructional choices, quantitative questions were the norm. Such questions create tallies that provide measurable standards for assessment and achievement. In 2000, Oliver and Towers made the argument for continuous re-examining of the ICT skills required for university. While their reasoning was in tandem to this research study, their research was primarily qualitative. Their demographic content was similar but a quantitative listing of the actual skills-of-the-day recommended by university staff was not collected (Oliver & Towers, 2000). Pelliccione (2001) surveyed university personnel regarding the ICT used in their teaching environments. Again, while the data compared changes over an 18-month period and the resulting data may have served as a timeline of sorts that was not the primary intent of the survey. In 2013, Parkes and Reading used a different survey construct to assess similar ICT content but their focus was on the ICT skills pertinent to e-learning. Their findings support the data collected here in that it emphasized the importance of basic skills that raise the level of online learning to an acceptable academic level. They found that "despite social constructivism being considered the predominant learning theory informing e-learning, many of the e-learning competencies associated with interacting and working with others were considered unimportant by e-learning stakeholders" (p. 787). These finding indicate that decision-makers may not have a clear understanding of what is required for effective e-learning. A student's ability to effectively use an ICT as a performance skill-set is as, or more, important than the transference of socially acquired ICT skills that lack academic relevance.

4.3.2 The importance of combining qualitative and quantitative formats

The combination of subjective and objective statements in one survey is not uncommon. In 2003, van Braak and Goeman developed a sustainable design for an ICT survey that combined qualitative and quantitative questions appropriately offering both Likert-type and Likert style responses in order to draw out the nuances of the technology-user relationship. Other research surveys followed, each individually nuanced but with similar goals and each employing an acceptable combination of quantitative and qualitative questions (Bhatnagar, 2013; Crisp & Palmer, 2009; De Wit, Heerwegh & Verhoeven, 2012; Elwood & MacLean, 2009; Grant, Malloy & Murphy, 2009; Haywood et al., 2004;

Keengwe, 2007; Kennedy et al., 2008; Li & Ranieri, 2010; Li & Walsh, 2010; Lofstrom & Nevgi, 2007; Peerear & Petegem, 2011; van Braak & Goeman, 2003; Venables, Miliszewska & Tan, 2012; and Wallace & Clariana, 2005). Researchers have long recognized the need for a combination of approaches when attempting to provide insight into the unique nature of technology in education. Although traditional checklist-type approaches can be helpful in weeding out materials in the initial phases of (ICT) evaluation, they do not sufficiently capture the multiple dimensions of effective evaluation in light of what we know about literacy learning today (Coiro, Karchmer & Walpole, 2006, p. 11). (See Appendix 2: *SurveyP-12* and *SurveyHE* Question Bank)

4.4 Survey data: Analysis methods applicable to end results

The digital subject matter and online delivery method supported innovative participant contact and data collection techniques. I systematically reviewed then rejected methods that did not provide the proper balance between subjective and objective data collection. Field studies, experimental simulations and judgment studies all involve researcher conjecture or supposition and were rejected for this reason. Conducting field experiments was rejected as it would introduce researcher hypotheticals and possibly influence the instructor's natural choice of instructional ICT. In order to minimize personal preferences that might influence the instructor's range of choice, I opted to design a generic survey based on established international ICT classroom curriculum. This allowed the respondent an objective field of ICT items choices to consider.

Rejecting a theoretical study was more difficult. Traditional liberal arts research involves proposing, then proving or disproving, a confidently stated thesis. Proving my theory required research methods that included and incorporated non-conventional resources. My choice was a compilation of methodologies or multi-methods which, in practice, included: clustering; correlations; descriptive statistics; multilevel modelling; online; and theoretical study. Table 11 provides a comparison of considered methods, their applicability to this thesis data, the rationale of selecting the appropriate methods that best serve each data type and the action taken.

Table 11: Methods, options, applications and selections

Data Type	Name & Method	Assessment & Action Taken
Qualitative	Action participatory-field research	Ideal for providing direct access to like-minded, critical thinkers. Disregard.
Qualitative	Case Study-field research	Too in-depth and longitudinal. Disregard
Qualitative & Quantitative	Cluster-structural	Data sorted into groupings. Applicable
Qualitative & Quantitative	Correlation-comparison	Use this with ICT skills relationships. ***Applied***

Data Type	Name & Method	Assessment & Action Taken
Qualitative & Quantitative	Data mining-multi method	Best used with large quantities of data. Disregard
Qualitative	Descriptive discriminant-comparison	Historical data grounds projection of future trends. Disregard
Quantitative	Descriptive statistics-structural	Draws generalizations from specifics. Analysis validity is dependable. ***Applied***
Qualitative	Ethnography-field research	Ideal for research into the meaning of actions within a cultural group. Disregard
Qualitative & Quantitative	Grounded theory-multi methods	Guidelines for using unique methods with validation. Monitor
Qualitative & Quantitative	Multi methods	Use of surveys and interviews to build on previous data. ***Applied***
Qualitative & Quantitative	Multilevel modelling-structural	Important to validity and usability of my data analysis. ***Applied***
Qualitative	Observation-Field-research	Too subjective. Ideal for work with behavior variables. Disregard
Qualitative & Quantitative	Online-Multi methods	Highly creative in scope. Will be an integral part of data collection. ***Applied***
Qualitative & Quantitative	Structural Equation Modelling	Addresses causal relations between both qualitative and quantities data. Applicable
Qualitative	Theoretical Study-structural	Identification of pertinent theories that arise during the data collection process. ***Applied***

4.5 Survey data: Analyses methods applicable to Likert variations

Likert-type questions are those in which each sub-item is independent and not directly interrelated to the other sub-items. In this survey, while the items were interrelated it was possible that an individual may develop one item without being required to develop other items in the same subgroup. A *Likert scale* is a multi-item scale in which the items are interrelated and the data is analyzed by comparing groups (Boone & Boone, 2012, p. 3). The survey collected quantitative responses using a Likert-type design. The nature of the subgroupings also allowed the option to reconsider, reorder, analyze and compare the ICT items as Likert Scale data in which the different items under a question are not simply listings but are inter-related or form a skillset.

Two surveys were developed. Twenty-eight ICT items were divided into subgroups loosely based on their purposefully-designed use. Post-Internet applications were similarly grouped by primary use. The 28 ICT items were contained in 6 questions each representing an industry-defined subgroup:

- Hardware
- Multimedia Presentations
- Interactive Applications
- Research and Data Management

- Spreadsheet Calculation
- Word Processing.

The 28 ICT items were presented in the same order and terminology on both the *SurveyP-12* and the *SurveyHE* though the exact wording was modified to fit the respondents' specific environment. Questions provided Likert-type scale ranging from 4-5 options. Before analyzing, all quantitative questions were recoded into three options: 3=Yes, 2=No and 1=No Opinion to provided comparable pre- and post-university assessment data. For validation purposes, questions regarding the use of L/CMS and interactive applications were not included in *SurveyP-12*. The researcher could not assure that there was a consistency of understanding the ICT among this group. Table 12 and Table 13 show the similarities and differences in the wording of *SurveyP-12* (International teachers) and *SurveyHE* (university instructors) question. The following sample addressed the use versus the need of spreadsheet skills. (See Appendix 2: *SurveyP-12* and *SurveyHE* Question Bank)

Table 12: *SurveyP-12* question format sample

International teachers were to answer:

A student will have these skills when they complete my course: SPREADSHEETS	**Yes**	**No**	**No opinion**
Understand terminology: column, row, cell, cell range	●	●	●
Can alignment and adjust column width & row height	●	●	●
Generate appropriate graphs e.g. bar, column, line	●	●	●
Use sum formula and undertakes basic calculations	●	●	●

Table 13: *SurveyHE* question format sample

University instructors were asked:

How important is it that your students have these SPREADSHEET SKILLS	**Yes**	**No**	**No opinion**
Understand terminology: column, row, cell, cell range	●	●	●
Can alignment and adjust column width & row height	●	●	●
Generate appropriate graphs e.g. bar, column, line	●	●	●
Use sum formula and undertakes basic calculations	●	●	●

Anomalies in the two cohorts were a consideration. Demographic data was compared to establish commonalities between respondent groups. By conducting the entire survey process online using institutional resources, the researcher provided limited opportunities for responses from educators with limited interest in personal or professional ICT use. Table 14 indicates the analyses appropriate to each data type (Boone & Boone, 2012, p. 3).

Table 14: Suggested data analysis procedures for Likert-Type and Likert Scale data

Analysis Goal	Likert-Type Data	Likert Scale Data
Central Tendency	Median or Mode	Mean
Variability	Frequencies	Standard Deviation
Other Statistics	Chi-Square Measure of Association	ANOVA or *t*-test

In general this study creates two convergent data records: the observations of the International teachers regarding their students' ICT skills and a timely snapshot of the ICT required in 2013 by Western higher education. Both individual and simultaneous analyses were conducted based on these two *independent variables* (the cohorts) and their relation to the *dependent variables* (28 ICT items). First, each survey was analyzed assuming that the responses were Likert-type data requiring tests for central tendencies, variability and associations. Once validity was established, the data was re-examined as Likert Scale, using mean and standard deviation tests to establish the nature and extent of any discrepancies between the two data sets. Before conducting statistical analyses, it was important to check that there were no violations of assumptions. This was done by collecting the descriptive statistics that would include the mean, standard deviation, range of scores, skewness (the asymmetry of the curve, see Figure 5) and kurtosis (the sharpness of the peak, see Figure 6) necessary to determine the central tendencies and dispersion patterns that would help guide the subsequent analyses methods. Appendix 17: *SurveyP-12* Data Master and Appendix 18: *SurveyHE* Data Master provides the skewness and kurtosis data for these 28 items.

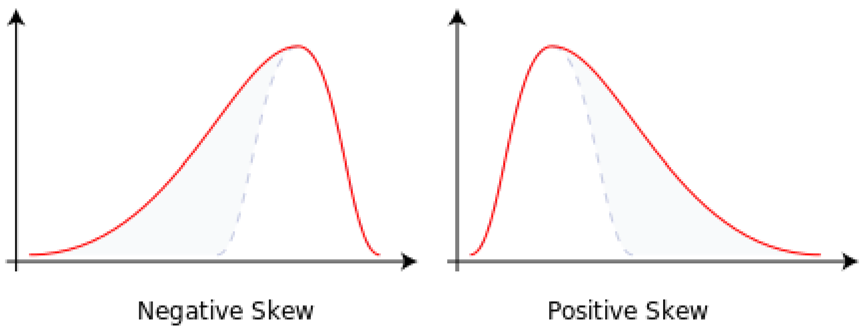

Figure 5: Skewness curves can be normal, positive or negative
(Statistics Help for Students, 2008)

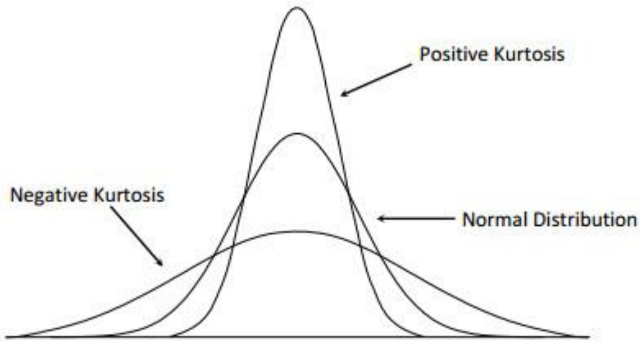

Figure 6: Kurtosis peaks vary from negative to positive according to distribution patterns
(Statistics Help for Students, 2008)

The Dual-Sample Independent *t*-Test for Equity of Means that included Levene's Test for Quality of Variance statistics was conducted to simultaneously compare the response means of the two independent variables, *SurveyP-12* and *SurveyHE*, in relation to the 28 dependent variables. The group statistics collected here would give additional data on the magnitude of difference between the two cohorts in regards to the 28 dependent variables. The Levene's Test of Quality of Variance would provide support for the strength of the comparison of each dependent variable sorted by independent variable. It would also indicate negative and positive leanings of the two cohorts in relation to the 28 dependent variables. The t-test for Equality of Means provided the Sig. (2-tailed), Means Difference and Std. Error Difference for each variable combination. These supported the range of negative to positive responses as well (statistics-help-for-students, 2009).

Exploratory factor analysis (EFA) could be described as orderly simplification of interrelated measures. EFA, traditionally, has been used to explore the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome. By performing EFA, the underlying factor structure is identified (Child, 1990, as cited in Suhr, 2006, p. 1). Principal components were then identified for each survey and Mann-Whitney *U* was subsequently used to compare the component outputs. The Mann-Whitney *U* test is appropriate to detect statistically significant differences between two independent variables and small sample numbers. Once discrepancies were identified, existing assessment and remediation solutions were examined.

4.5.1 Assessing foreign students' ICT skills by proxy

Academically relevant ICT research data from developing countries in Asia, Africa and the Middle East is only now appearing in numbers comparable to existing Western data. Supported by the OECD and UNESCO, developing countries continue to chronicle their ICT integration and the advancements of their students and teachers. Teacher-focused research commonly looks at both the internal and external factors that influence an educator's ICT choices (Bertram & Waldrip-Australia, 2013; Guoyuan, Valcke, van Braak, Tondeur, & Chang-PRC, 2010; Kir & Kayak-Turkey, 2012; Li & Walsh-PRC, 2010; Moran, Seaman & Tinti-Kane-USA, 2011; Peeraer & Petegem-Vietnam, 2011; Usleul, Askar & Bas-Turkey, 2008; & Zhu-PRC, 2010). One research study developed a baseline of ICT used at Curtin University in 2001. Part of a larger study of the changes in ICT use over a period of time, Pelliccione's survey included demographic questions and canvased many of the same ICT items included in this research. The commonality of the skills used and the recognition, by other researchers over a considerable period of time, of the need for a skills baseline are relevant factors when establishing the provenance of this study. They set precedent and, based on existing surveys, future researchers are confident when including questions relating to personal and professional ICT use for both instructors and students. However, data on ICT use becomes obsolete quickly and Pelliccione's 2001 study, and others, no longer reflects current usage in Western higher education. *SurveyHE* was based on the survey construction used by these past researchers. It is important to note that the findings, methodologies and development timelines established in these earlier surveys reemerge in importance when constructing programs for developing countries.

The decision to seek out teachers for this study was supported by research that indicated surveying the students' directly would not produce conclusive results (Jung, 2009, p. 43; Li & Ranieri, 2010, p. 139). It was challenging to identify, and then isolate, a group that could speak for the commencing foreign students. Primarily Western-trained, International teachers might be expected to possess academic knowledge, classroom experience and professional training in assessment and evaluation according to Western standards. Survey data of the ICT items these teachers observe in their senior-level students would provide an effective overview of the ICT skills a Western university instructor might reasonably expect from the commencing foreign student. Once the International teacher cohort was selected as proxy a new challenge arose. International teachers, as a group, are relatively unrepresented. With no comprehensive organization, contacting these teachers would require creative options that could be verified and validated to meet academic standards. Common gatherings of International teachers were sought out: personal data bases, formal member organizations; teacher recruiting agencies; International school websites; school certification services; and school accreditation groups, thirty-five LinkedIn teacher-represented blogs and forums, Chinese middle-school administrators and Chinese teacher professional websites. The next challenge was to create a simple survey that could be issued online to people with different native languages yet still gather data that would be comparable to the controlled Western university survey and subsequent Academic ICT Baseline. Again, the commonality of teacher-training proved beneficial. Teachers in the PRC, and other non-native English speakers, were accommodated by an additional language translation. The number of respondents who accessed the survey in a language other than English is not known. However, the number of responses received in languages other than English was less than 10 and all of these were Mandarin Chinese. This did not affect the coding of their responses. The survey included 6 ICT questions, each representing a pre-determined skillset: in total 28 Likert-type items. The item responses were coded during analysis into three levels: 3=Yes, 2=No and 1= No opinion. By strict definition this is a scant number of response options for a Likert question. However, the respondents spoke over 20 different native languages and the researcher believed that the terms *Yes* and *No* were definitive in most of these languages. To reduce linguistic confusion with terms such as *somewhat* or *often*, a highly simplified scale was used. A limited number of analytical treatments were used to validate the International teacher survey responses. In general, each subsequent analysis indicated that there was tacit agreement on the specific ICT items that were present and the skills that were lacking in the foreign school environments. Statistical testing was kept simple as validity, internal consistency and association was easily established. The same analytical processes were applied to the International teachers and the university educators: first singularly and then in comparison.

4.5.2 Higher education: What are the variables at play in ICT use?

Three questions guided the design of the master survey content.

1. What are their ICT demographics?
2. What are their ICT training, background and professional development experiences?
3. What ICT are they currently using in daily instruction?

Researchers tailor survey questions to gather information relevant to their needs. To understand ICT use in higher education, the classroom educator must express how and why they choose instructional ICT. Does background, training, professional development or personal preference influence their ICT decisions? Are they swayed by time and convenience? Demographic data was collected that allowed examination of the instructors' ICT use driven by various determinants: age, gender, educational and teaching experience, professional development, personal and professional familiarity with ICT, ICT usage habits both in and out of the classroom, preferences of operating systems, hardware and software for personal use. Subjectivity was evident in the responses and required that, in some instances, analyses balance ICT choices with the expressed value-judgments of the respondents. For example: the daily use of L/CMS requires that instructors to learn and produce curriculum for online delivery. Analysis methods, such as correlation comparisons, were directed at detecting attitudes toward L/CMS acceptance, adoption and effectiveness. A standard combination of qualitative and quantitative analyses procedures was applied to this data: comparing frequencies, identifying descriptive components, testing for validity, eliminating assumptions and analyzing and comparing components and factors. Creating an Academic ICT Baseline was straight-forward.

4.5.3 Text data analyses

Text entry on selected questions and an invitation to post-survey interviews were the options provided to elicit commentary. Respondents were also asked to provide the names of RPS and emerging or content-specific ICT they recommended for student use. (See Appendix 15: Research Production Skills recommended for higher education) This data would be used to develop a personalized student advisement package that would influence assessment and remediation programs. In order develop a *feel* for their personal interest in the research topic, respondents were asked to volunteer for a post-survey online interview. These interviews were difficult to arrange and only a portion of them were completed. The structure of the interview process was to use the respondent's actual survey responses to build a list of relevant questions regarding highly implicit, missing or conflicting survey responses. *SurveyP-12* respondents developed spontaneous dialogues online volunteering unsolicited commentary that provided additional support for the relevance of the research thesis and textural information for the analysis process.

Leximancer©, a unique analysis tool that could detect the relevant, reoccurring data embedded within these conversations was used on the text data from both surveys. Leximancer© is an online application designed by Leximancer Part Ltd, in Brisbane, Australia. The process analyzes two stages of co-occurrence information extraction—*semantic* and *relational*—using a different algorithm for each stage. The algorithms used are statistical, but they employ nonlinear dynamics and machine learning (Smith & Humphries, 2006, p. 262). By selecting words based on frequency and co-occurrence, Leximancer develops inter-relational formats that can be analyzed for cross-meanings and detecting concept-building relationships. Using Leximancer, the raw text data from each survey were analyzed and a visual representation created. Leximancer also provided a Pathways Report option that created a visual connection between random words in the given context of the overall text. For example: if the given context is *ICT* we can ask the question *What skills do students need?* In this case of the *SurveyP-12*, the word *student* was selected as initial-point and the word *need* selected as the end-point. Leximancer generates a Pathway between these two words, connecting through other relevant words in order to create a model or path that accounted for 100% of the text variance. The same procedure was applied to the interview and other text responses derived from the *SurveyHE*. In this instance, using the same context of *ICT,* the initial-point was *skills* and the end-point word was *needs.* The Pathway generated between these two words was indicative of the ICT-related text in this context and accounted for 100% of the variance. Statistical data was also produced to show co-occurrences of text. The suggested co-occurrences when examined in the context of the actual responses provided the support necessary to develop an additional comparison tool that could be applied to the two different surveys. (See Appendix 19 and Appendix 20 for Leximancer data)

4.6 Dual data - comparative analyses

Research question 3 asks: *What is the nature and extent of the Academic ICT Gap between the ICT skills of a non-Western-educated P-12 student and the ICT skills required to undertake a Western university program.*

Following individual analyses, the data from the two surveys were combined into one SPSS file and new analyses procedures were selected for collecting comparison data. Table 15 shows the options for both parametric and non-parametric data testing.

Table 15: Parametric and non-parametric data analysis options

Conditions	Parametric	Non-parametric
Assumed distribution	Normal	Any
Assumed variance	Homogeneous	Any
Typical data	Ratio or Interval	Ordinal or Nominal
Data set relationships	Independent	Any
Usual central measure	Mean	Median
Benefits	Can draw more conclusions	Less affected by outliers
Tests		
Correlation test	Pearson	Spearman
Independent measures, 2 groups	Independent-measures t-test	Mann-Whitney test
Independent measures, >2 groups	One-way, independent-measures ANOVA	Kruskal-Wallis test

(Hoskin, 2014, p. 2)

Shapiro-Wilkes was considered then rejected when the distribution indicators were determined to be inconsistent. Non-parametric testing would be less sensitive to unstable distribution factors. Kruskal-Wallis testing was considered but the number of independent variables (2) was not optimal for this test. Data analyses were better serviced using Mann-Whitney *U* testing. This test provided acceptably stable conditions upon which frequencies and descriptive analyses could confidently be conducted.

4.7 Assessment and remediation determined by use and outcome

Applicable assessment and remediation tools were sourced from existing educational and commercial programs. No one program fit all needs and it remains the program developer's responsibility to determine the range of testing tools and the appropriate fit to each circumstance. A comparison of various programs, both national and international, was reviewed. Each option had positive and negative aspects that must be considered according to its intended application and the desired outcome. The existence of a broad range of assessment tools supports their importance. (See Appendix 6: Commercial and educational assessment tools)

4.8 Chapter summary

This thesis postulates that if an Academic ICT Gap exists it is: intellectually arguable; difficult to validate using available research; and an uncomfortable concession for those who would need to redirect resources and adapt policies to reverse it. It is easier to deny need and argue that *fast-fingering* skills indicate a competence in academic-grade ICT skills. Yet the Academic ICT Gap is a logical conclusion to historical records and is in evidence every day on university campuses and in classrooms.

Elements of this thesis research were unique and required a creative approach when seeking resources and choosing methodologies. Unique to this research were:

- Survey design - a variety of methodologies based on a succession of earlier ICT surveys were considered. However, none were perfectly fit for this study.
- Question formats - The general format of both the quantitative and qualitative questions, the offer of both closed- and open-ended multiple choice, Likert-type and Likert style response options, as well as the content framework, were validated against common commercial and academic practices.
- ICT item selection – The provenance of the specific ICT items was provided by curriculum standards from three continents developed over a decade of ICT integration.
- International respondents - The suitability of the International P-12 teacher to serve as the proxy spokesperson for the foreign student's ICT skills has been established.
- Survey distribution *SurveyHE* - University personnel were easily identified and recruited using publically-available institutional email addresses.
- Survey distribution *SurveyP-12* - International teachers, a largely unrepresented cohort with no organized channels of contact, were contacted through International school websites, recruiting organizations, Chinese school administrators and Asian teachers' professional websites, referred by colleagues and sourced from personal data bases.

The literature reviewed in the previous chapter indicated that computers are ubiquitous in all levels of Western education. To say they have been successfully *integrated,* as envisioned by early academic supporters, is a polemic assumption not addressed by this study. The university instructors' ICT skills expectations expressed in the survey responses is based on standard, western p-12 technology curriculum. Western domestic students are expected to have acquired these skills in their preparatory training; therefore it is also expected of every foreign student who accepts admission to Western higher education. To test this assumption, the institution should collect and analyze ICT data from all students and then transparently disseminate the findings to future students and their teachers. Higher educations' dependence on ICT and other computer-related technologies is pervasive. Yet, the practice of haphazard adoption of computer technology into educational settings results in unintended and irrevocable changes in the efficacy of curriculum and learning. Every element of this study was designed to gather data that would assist in closing the Academic ICT Gap by providing unique, relevant information upon which sound academic decisions can be based. Methodologies and resources were kept simple and transparent in hopes that this data will be easily understood and used by administrators in both P-12 and higher education in developed and developing countries.

5 RESULTS

"Correct assumptions are what an institution gets paid for: they are their theory of business*"*

(Peter Drucker, Harvard Business Review, 1994, p. 96)

In 2015, International education earned $19.65 billion Australian dollars, making it one of the top-three resource generators for the country (Smith, B., 2016, para. 1). Once insular institutions, universities must now compete in the growing, aggressive academic-cum-commercial international marketplace. By applying to universities in record numbers, foreign students present Western academic decision-makers with unique challenges, causing them to re-examine traditional business models, academic policies and procedures. University decision-makers are not known for making rash decisions and this competitive environment is unique: exacerbated by digital technologies, with no precedents upon which to base decisive action. Faced with both increasing foreign student numbers and the ubiquity of computers, higher education must improvise a new *theory of business* or be overtaken by competition from more flexible providers. University decision-makers require concrete, timely data, logical in its application, from which flexible, responsive plans of action can develop.

5.1 Survey Primary through Secondary - ICT skills analyses

Research question 1 asks: **What are the ICT skills of a non-Western-educated P-12 student.**
In developing countries, the source of many of today's commencing university students; it is the International teacher who provides English-language learning, the curriculum most commonly associated with the use of ICT. Educated and certified by their home country, they bring legitimacy and professionalism to the International school environment. These teachers, as an adjunct to their English-language instruction, may provide the only formal ICT instruction many of these students will receive. Because there is a lack of prescribed learning, the ICT these teachers use reflects their professional and personal experiences. For this reason alone these teachers become a valuable resource for practical insight into the preparatory ICT experiences of the university bound foreign student. Traditional analyses processes were used to establish the validity of the International teachers' survey responses. (See Appendix 7: *SurveyP-12* Demographic question responses for more information)

5.1.1 *SurveyP-12* variability analyses based on response frequency

Frequency statistics showed weaknesses in 10 items with variability testing indicating that only 32%

to 54% of the foreign students could be expected to have mastered these 10 items. These same 10 items also had a high incidence of No Opinion responses which further supports a lack of observable ICT in the foreign classroom. Table 16 provides the response frequency data on the 10 sub-par central tendency items. The column Yes% indicates the percentage of foreign students who might be expected to have the ICT items in question.

Table 16: Response frequency comparison of sub-par Likert-Type items.

	Response Frequency Numbers and Percentage			
ICT Item	**Yes %**	**Yes**	**No**	**No Opinion**
Interactive applications-web design	32%	39	53	30
Interactive applications-3D animation	35%	43	51	29
Spreadsheets-formulae & basic calculations	44%	55	43	28
Spreadsheets-generate graphs/charts	45%	57	41	30
Interactive applications-mapping & GPS	49%	61	34	29
Spreadsheets-terminology: column/row/cell	50%	65	37	27
Spreadsheets-alignment/adjust column/rows	52%	66	35	27
Research & data-select search sites/accurate information	53%	67	38	22
Research & data-advance search subject/key word/author	53%	68	36	24
Hardware-tablets	54%	66	32	24

The ***chi*-square goodness-of-fit** test was conducted on the 28 items and the resulting data reinforced a lack of the same 10 items as indicated by the mean and variability testing but with an additional 3 items. These 13 ICT items all had lower expected cell frequencies than the 46.7 required to reject the null hypothesis. All 28 ICT items had $p>.05$ so the null hypothesis can be rejected for these items and it can be assumed there is a goodness of fit to the general population. The final test of the 28 items of Likert-type data was to determine the internal consistency. **Cronbach alpha** testing was conducted to estimate the proportion of variance that is systematic or consistent in a set of items (Brown, 2002). It can range from 0.0 (if no variance is consistent) to 1.0 (if all variance is consistent). The Cronbach's alpha reliability coefficient (>*p* value) for the 28 ICT items in question ranged from .967 to .968 (28 items; $\alpha = .968$). Therefore the questions were considered to be highly reliable with a high level of internal consistency since a Cronbach's alpha >0.8 is taken to assure validity (DeVellis, 2003; Kline, 2005). Table 17 lists the *chi*-square, Asymp. Sig. and Cronbach's alpha for the 13 sub-par ICT items as indicated by analyses testing. (See Appendix 17: *SurveyP-12* Data Master for the Cronbach alpha per item)

Table 17: *SurveyP-12* Goodness of Fit and Reliability statistics for 13 sub-par ICT items

ICT Item	Goodness of Fit & Reliability		
	chi-Square	Asymp. Sig.	Cronbach alpha
Hardware-PCs & laptop	6.0	.049	.968
Hardware-webcams	6.6	.037	.968
Spreadsheets-generate graphs/charts	8.6	.013	.967
Spreadsheets-formulae & basic calculations	8.7	.013	.968
Hardware-print/copy/scan	14.3	.001	.968
Spreadsheets-terminology: column/row/cell	18.0	.000	.967
Spreadsheets-alignment/adjust column/rows	19.9	.000	.967
Research & data-terminology: fields/records	24.3	.000	.967
Interactive applications-social media	24.5	.000	.968
Research & data-sort data, add/delete records	24.6	.000	.967
Hardware-USB & file storage	28.9	.000	.968
Research & data-uses hyperlinks & navigation	31.9	.000	.967
Research & data-record/catalogue/cite references	36.8	.000	.967

5.1.2 *SurveyP-12* Exploratory Factor Analysis

Exploratory factor analysis (EFA) is the initial analysis conducted when the structure of the variables is not apparent. In the case of the ICT content in this study, the factor structure of the variables was pre-determined, as the items were created in common, task-related subgroups: word processing, graphic design, etc. However, would the introduction of Internet skills and online applications redefine the relationship between the traditional skillsets? EFA would test the efficacy of the traditional subgroups and identify the non-traditional outlier-items that developed by including emerging technologies in the recombined analysis. The appropriateness of EFA as the initial analysis process was confirmed by the simplicity of the resulting report data. All of the observed variables had solid relationships with each other. EFA indicated the mean range from 2.05 to 2.70 and the standard deviation range from .623 to .805. Table 18 indicates that the KMO is in the *meritorious* range (>0.8) and the Sig. value of the Bartlett's Test of Sphericity indicates that there are correlations in the data set that are appropriate for component analysis.

Table 18: Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.899
Bartlett's Test of Sphericity	Approx. *chi*-Square	3550.536
	df	378
	Sig.	.000

The EFA Residual Correlations Matrix ranged from .592 to .911 indicating that all 28 items correlated strongly with each other and should be included in the principal component analysis process. (See Appendix 17: *SurveyP-12* Data Master for a more complete data report)

5.1.3 *SurveyP-12* Principal Components Analysis

Principal component analysis (PCA) is used to emphasize variation and bring out strong patterns in a dataset. It's often used to make data easy to explore and visualize (Powell & Lehe, 2015). The PCA indicated that the components sorted into the relatively traditional skillsets. As preparation for comparison of these responses with the *SurveyHE* responses, principal components analysis was conducted to determine if the 28 items had continued, in the case of foreign student use, to *load* into the same subgroups as initially indicated by the EFA. *SurveyP-12* data produced a simple component sort and the six subgroups remained relatively intact. That the word processing item *creating text boxes* loaded on the spreadsheet component is an indication of the interrelation of the office applications. Likewise, the interactive item *social media* is naturally related to the hardware used to interact with the Internet, such as *smart phones* and *tablets*. In order to get a clean loading of items, the critical Eigenvalue was restricted to 0.4. Eliminating items loading on components with an Eigen factor >0.4 provided a higher-than-average component positioning and validity of component items. Setting a higher critical Eigen factor also helped to limit random outliers that could occur in lower critical Eigen factors. These component loadings accounted for 80% of the variance or residual differences. This meant that of all variance (100%) between the individual items factored, 80% was accounted for in this particular arrangement and loading of the 28 items into these 5 components. This was another proof of validity and justified the decision to use a high critical Eigen value in the loading process.

The item *word processing-create text boxes, use borders, columns* is complimentary to the items loading in the spreadsheet component. However, International teachers also placed this skill in its proper context of word processing. This may indicate a traditional approach to the ICT instruction in a foreign school. The actual tasks conducted when creating a spreadsheet have a heavy component of word processing skills as numeracy and literacy are mutually supportive and many spreadsheets serve cross-purposes as commercial documents or as elements of sales and marketing materials and presentations. Table 19 shows the *SurveyP-12* ICT items mathematically grouped into 5 components, each represented by a color indicating the ICT items that loaded onto that component. In the care of *Word Processing-create text boxes/borders/columns* and *Interactive applications-social media* the ICT Item loaded strongly on more than one component indicating its importance to more than one skillset.

Table 19: *SurveyP-12* Principal components rotated matrix-Eigen .4 = 80.35% Variance

ICT Item Sorted by Subgroup	Word Processing	Spreadsheet	Research & Data	Interactive Application	Hardware
Word processing-select/highlight/cut/copy/paste	.816				
Word processing-create text boxes/borders/columns	.667	.412			
Word processing-reference/thesaurus/language tools	.728				
Word processing-page orientation & document layout	.763				
Multimedia-clear/concise/logical presentations	.755				
Multimedia-effective presentation design/layout	.789				
Multimedia-graphics/clip art/images in presentations	.775				
Multimedia-select/delete/crop/copy	.779				
Spreadsheets-terminology: column/row/cell		.769			
Spreadsheets-alignment/adjust column/rows		.806			
Spreadsheets-generate graphs/charts		.779			
Spreadsheets-formulae & basic calculations		.800			
Research & data-advance search subject/key word/author			.775		
Research & data-select search sites/accurate information			.785		
Research & data-record/catalogue/cite references			.797		
Research & data-terminology: fields/records			.823		
Research & data-sort data, add/delete records			.781		
Research & data-uses hyperlinks & navigation			.802		
Interactive applications-3D animation				.653	
Interactive applications-ESL & translation				.706	
Interactive applications-mapping & GPS				.768	
Interactive applications-social media				.538	.515
Interactive applications-web design				.614	
Hardware-PCs & laptop					.753
Hardware-USB & file storage					.795
Hardware-print/copy/scan					.759
Hardware-tablets					.703
Hardware-webcams					.819

The loading pattern of the Survey-12 items into 5 principal components established a guideline for the number of principal components that would be investigated in the *SurveyHE* data. It was hoped that the *SurveyHE* items would load efficiently into 5 components and account for an acceptable level of variance. This would make the final comparison of the two survey data more distinctive.

The Academic ICT Gap

Once the individual survey analyses were completed, these principal components were compared with the principal components extracted from the *SurveyHE* data to expose the Academic ICT Gap. (See Appendix 8: *SurveyP-12* Principal Components Analysis Total Variance Explained)

5.1.4 SurveyP-12 analysis of unsolicited commentary

A university email address was included in all survey documentation and invited comments and question from respondents. Of the 134 total respondents, 14 International teachers expressed interest and an online dialogue developed: addressing the merits of the study; the efficacy of International teaching in general terms; and, their personal experiences with ICT teaching around the world. One respondent questioned the appropriateness of singling out the Asian student for study, asking "Don't you believe that this ICT issue exists for all students who's instructors and schools are not focused in developing students for university work?" This comment was acknowledged by pointing out that the size of the study cohort was intentionally restricted but that the resulting data could be applied to most any student cohort in any location.

The majority of the conversations recounted similar experiences or provided information about how their experiences brought to light issues particular to their regional areas. Two comments from Pakistan supported findings that great effort is being made there to recognize the importance of ICT in learning. "ICT is now very much integrated in curriculum of teachers in Pakistan especially in language learning wherein CALL is being promoted. The end result is students are responding positively with better SLO [student learning outcomes]. The expertise of the teacher in using ICT is of course a very significant area." School systems are bringing forward ICT integration on all fronts and teachers are optimistic about the changes. However, about 60% of the general populace is still skeptical about the general benefits.

Ten of the commentators had experience in more than one Asian country as well as in the UK and/or the EU. They offered their own comparison studies of domestic and foreign student skills. The majority agreed that the domestic student was often not as prepared for tertiary education as instructors might hope and as parents and administrators might assume. The comment that the 'digital natives' were not as adept as expected was made more than once. However, from teachers in the EU/UK, the opinion was that the Asian students' ICT skills were markedly lower than their domestic counterparts. One ESL teacher of pre-university students in both Asia and the UK noted:

> My students do not have the ICT skills we would consider basic in Word, Open Office etc. In fact, many of my 'kids' have shiny new Macs they can barely use. Many of my International students, despite being of the 'Internet Generation' have never been taught the difference between a personal, business or educational blog, let alone a

> blog and an academic article. I am more concerned about their lack of Internet research skills.

Another with extensive Asian experience in secondary schools offered even more detail and included students from countries often assumed to have well-integrated school systems.

> Most of my East Asian students (Japanese, Koreans, Chinese and Taiwanese) know VERY little about simple document formatting (margins, indents, page size, columns, tables) type face, manipulation (type size, style) inserting/manipulating graphics and most of the other seemingly 'basic' elements of standard documents. My Int'l students have no clue about how to conduct research using Internet searches. Ten years ago we offered a 'basic elements' of texting/formatting course which was very popular and even produced a simple academic publication each semester. It was hugely popular but is no longer offered. These courses need to make a comeback.

Another teacher of pre-university students in Japan echoed these observations. "My Japanese university students were sorely lacking in ICT skills and knowledge which is not only important for study abroad but to be competitive in their local job market." By far, the greatest number of spontaneous comments came from both native Chinese teachers and Western teachers with considerable Chinese experience. Their remarks fully supported the contentions of this research study. Here is a compilation of their comments.

(a) To be very honest the students here in China are nowhere close to having the ICT skills needed to succeed at a Western university. We had only 2 hours a week of computers and that class often gave way to 'more important' courses like Chinese, maths or English. Many teachers and parents think computers and Internet distract kids' attention from study. They are afraid the kids will indulge in games instead of showing students good examples of discipline and intelligent ways of using computers and the Internet. They look at ICT as the enemy, even though they know quite well ICT is important for the kids' future. They think the kids will learn [computers] anyway in university or at work.

(b) Public school students are not allowed to have electronic devices on campus. Many of these schools are boarding schools. Cell phones are a problem as students use them to cheat but banning them is a problem for parents who want to be able to contact their kids.

(c) Many, not all, Chinese middle and high schools have computer labs but access for the students is limited. Students' only interaction with computers is from the school courseware which is quite basic and from their phones they bring to class. There was no English computer science teacher only an ESL teacher assigned to computer science classroom and no computers in other classrooms other than for PowerPoint presentations.

(d) The students were very interested in ICT but had inadequate instruction. It seems almost teachers of ever subject have to 'teach' students about ICT, such as how to search the database with keywords, how to pin down criteria or filter for relevant information, how to format papers and reports, etc. Since ICT is so important for

> their future, why not let them know about if as soon as possible before tertiary education? Unfortunately that is not possible in the test-oriented secondary education (in China).

In summation, these teachers agreed that the problem was bigger than only one nation or institution but that it was pervasive and threatened the learning experience.

> Based on my experience with European students, I seriously doubt that this is a "Chinese" problem. The question we should be asking is not whether Chinese students are up to our " Western standards" but rather how can we help our students (wherever they come from) acquire the kind of ICT skills we want them to have.

5.1.4.1 Leximancer concept map and Pathway

Leximancer analyzed over 3,600 words of text from 12 *SurveyP-12* respondents. All researcher text was removed and the raw text response data produced a concept map of the commentary. Six major concepts housed in 5 dominant themes were detected. The dominant themes, indicated by the larger bubbles, were: *computer, education, ICT, students* and *use*. A Pathways line was generated to show the most proficient connections between two points or terms. Two concept-terms critical to this research were selected, *student* and *need,* as the start and end points. The dark arrow, or Pathway, indicates a directional relationship between these two words. These two critical concept-terms connected through *ICT, skills* and *learning*. The application provided the percentages of accountability (total 100%) of each step along the pathway: student to ICT (.31%); *ICT* to *skills* (.46%) *skills* to *learning* (.11%) and *learning* to *need* (.12%). Other related terms were in proximity, such as *language, teaching* and *experience.* However, these terms were not as relevant to fulfilling the accountability percentage as the selected Pathways combination. The International teacher responses indicated that their students *need* educational experience in the ICT. Figure 7 shows the concept map highlighting the 5 dominant themes and the indicative Leximancer Pathways arrow connecting *students* to their *ICT needs*.

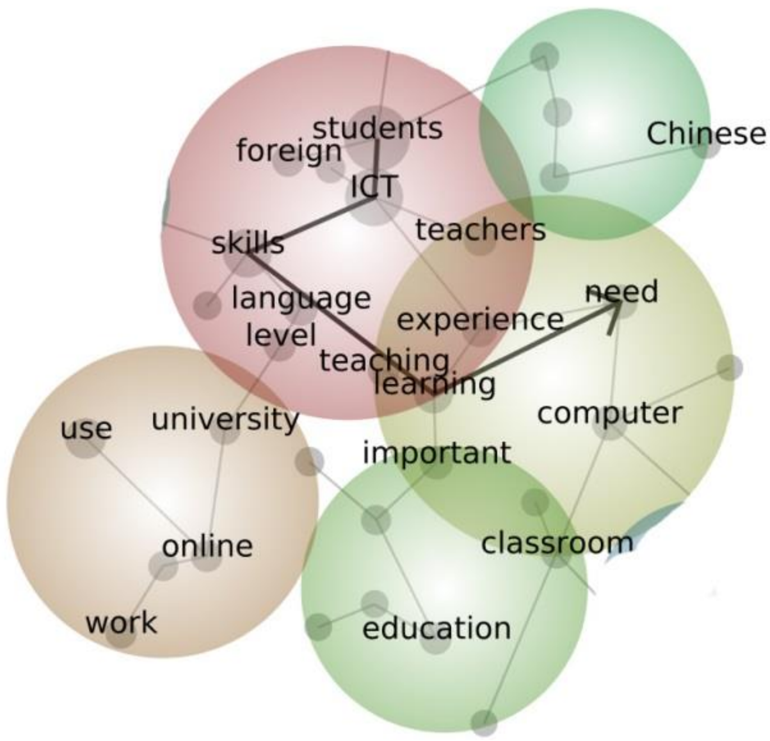

Figure 7: Leximancer concept map of *SurveyP-12* respondent commentaries

5.1.4.2 Ranked individual and compound concepts for categories

Leximancer provided data tables sorted by both individual and compound concept strengths. In the individual concept table the prominence rating is calculated by measuring the combination of the concept's strength of use and the relative frequency of occurrence in the overall text. Both Categories and Concepts must be considered in the context of the topic of text discussion: computer use in education. Strong representations were made in both *ICT* and *education* categories, with *important* indicated as the strongest modifier of these categories. Table 20 indicates the full range of prominence statistics. The most noted category/concept combinations are indicated in RED.

Table 20: Ranked individual concepts for categories

Category	Concepts				
	experience	*learning*	*important*	*need*	*skills*
computer	1.7	2.3	1.2	1.4	0.8
ICT	2.9	1.5	1.3	1.9	2.8
use	0.9	1.1	0.0	1.4	1.4
education	2.4	1.6	4.8	2.0	1.1
students	1.9	1.1	0.9	1.6	1.6

Table 21 indicates the prominence rating of certain concepts when partnered with other concepts. Leximancer generated 11 concept combinations where the most prominent determinant in an ICT context was the *importance of learning to education.* Combinations of concepts will only occur in a given category if warranted by the relative frequency and the strength of the indicative combination resulting in a prominence figure >0.1. The most noted concept combinations are indicated in RED.

Table 21: Ranked compound concepts for categories

Concept Combinations	Categories				
	computer	*education*	*ICT*	*students*	*use*
experience & learning				6.3	
experience & need			11.9	7.8	
experience & skills			6.7	4.4	
importance & learning		47.7	4.8		
learning & skills	5.9				
need & important			8.1		
need & learning			3.9	5.1	
needs & skills		10.1			
skills & important			4.5	3	
skills & learning			4.4	2.9	3
skills & need			5.5	1.8	

Interpreting the prominence statistics in relation to the concepts and categories generated indicates that ICT experience is needed; that they are important to educational learning; and, that these skills are needed in an educational context.(See Appendix 19: *SurveyP-12* Leximancer Data)

5.2 Survey Higher Education – ICT skills analysis

Research question 2 asks: **What digital ICT skills are required to undertake a Western university program.** To answer this question an Academic ICT Baseline of the ICT used in Western education was developed. The following data was collected between March and May, 2013. Qualtrics Survey Software© issued 3361 anonymous email invitations to university staff of which 353 (10.5%) surveys were completed. While 10.5% is a respectable response-rate percentage the total number of respondents bordered on the minimum number the researcher required for this survey to be representational. For this reason, a range of analyses were conducted to establish validity and consistency of the responses. Additional demographic data was collected on the respondents' personal and professional ICT use which helped in developing a reasonable understanding of the respondents as a group. (See Appendix 9: *SurveyHE* demographic question responses)

5.2.1 *SurveyHE* variability analyses based on response frequency

Frequency statistics indicated that 18 of the 28 items are required by over 70% of the educators and that 21 of the 28 items were considered important to over 50% of the respondents. The 7 items shown below were considered important by less than 50% of the respondents however these percentages were influenced by the no opinion category. The **variability analysis** indicated that having no opinion was more influential in disordering these items than expressing a formed opinion. Table 22 displays the response frequency of the 7 lowest performing ICT items surveyed. The column Yes% indicates the percentage of *SurveyH*E respondents who considered the ICT item important to their students' work.

Table 22: Response frequencies of 7 sub-par ICT items

	Response Frequency Numbers and Percentage			
ICT Item	**Yes %**	**Yes**	**No**	**No Opinion**
Interactive applications - 3D animation	19%	66	183	104
Interactive applications - ESL & translation	23%	80	162	108
Interactive applications - web design	26%	92	161	98
Interactive applications - mapping & GPS	27%	96	141	114
Hardware - webcams	43%	151	92	112
Interactive applications - social media	45%	160	122	71
Hardware - tablets	45%	161	86	107

The ***chi*-square goodness-of-fit** test was conducted on the 28 items and the resulting data reinforced a lack of the same 7 items as indicated by the mean and variability testing but with one additional item. The cell frequencies for these 8 items were lower than the 117.7 required to reject the null hypothesis. None of the 28 ICT items had Asymp. Sig. scores of more than .05. Twenty-seven of the 28 items were >.000 while mapping and GPS skills was .012. As all ICT items had p>.05, the null hypothesis can be rejected for these items and it can be assumed there is a goodness of fit to the general population. Using **Cronbach alpha** to determine internal consistency was the final test conducted on the 28 items. The Cronbach's alpha reliability coefficient (>p value) for the ICT items questions ranged from .859 to .869 (28 items; α = .868). Therefore the questions were considered to be highly reliable with a high level of internal consistency since a figure of Cronbach's alpha >0.8 is taken to assure validity (DeVellis, 2003; Kline, 2005). Table 23 lists the *chi*-square, Asymp. Sig. and Cronbach's alpha for the 8 sub-par ICT items as indicated by analyses testing. (See Appendix 18: *SurveyHE* Data Master)

Table 23: *SurveyHE* Goodness of Fit and Reliability statistics for 8 sub-par ICT items

ICT Item	Goodness of Fit & Reliability		
	chi-Square	Asymp. Sig.	Cronbach alpha
Interactive applications-mapping & GPS	8.8	.012	.866
Hardware-webcams	15.2	.000	.864
Interactive applications-web design	25.0	.000	.869
Hardware-tablets	25.4	.000	.865
Interactive applications-ESL & translation	29.8	.000	.869
Interactive applications-social media	33.9	.000	.866
Interactive applications-3D animation	60.6	.000	.869
Research & data-sort data, add/delete records	111.5	.000	.869

5.2.2 *SurveyHE* Exploratory Factor Analysis

As with the *SurveyP-12*, an EFA was conducted on the *SurveyHE* data. Again, the factor structure of the variables was pre-determined, as the items were created in common, task-related subgroups: word processing, graphic design, etc. EFA would test the efficacy of the traditional subgroups and identify the non-traditional outlier-items that developed by including emerging technologies in the recombined analysis. Many of the *SurveyHE* indicators were similar in range to the *SurveyP-12*. The EFA indicated the mean range from 1.89 to 2.96 and the standard deviation range from .264 to .858. Table 24 indicates that the KMO is in the *meritorious* range (>0.8) and the Sig. value of the Bartlett's Test of Sphericity indicates that there are correlations in the data set that are appropriate for component analysis.

Table 24: Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test of Sphericity

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.857
Bartlett's Test of Sphericity	Approx. Chi-Square	3611.429
	df	378
	Sig.	.000

The EFA Residual Correlations Matrix ranged from .363 to .876. While the lowest correlation was .363, the average of the 28 items was .651 indicating that all 28 items correlated strongly on each other and should be included in the principal component analysis process. (See Appendix 18: *SurveyHE* Data Master)

5.2.3 *SurveyHE* Principal Components Analysis

For comparison with the International teachers' component extraction, the critical Eigenvalue for the sort was set to 0.4. The number of components was limited to 5 and this configuration accounted for 65.15% of the variance or residual differences. By eliminating those items with an Eigenvalue >.4 two Word Processing items were discounted. Noted here in RED for discussion's sake, the item *Word processing-page orientation* loaded strongly on two components, Word Processing and Research and Data: adding validity to the importance of this seemingly marginalized skill. It was not uncommon for language-related skills to be ranked below other production-oriented ICT and this is an anomaly addressed in later analysis. In keeping with earlier analyses, the Hardware item *tablets* and *webcams* were isolated from other Hardware and had marginal Eigen values. The remaining Hardware items, *computers, USB* and *print/copy/scanners* loaded with the primary component they support: Word Processing. Table 25 shows the *SurveyHE* ICT items mathematically grouped into 5 principal components, each represented by a color indicating the ICT items that loaded onto that component. In the case of *Word processing-create text boxes/borders/columns, Word processing-page orientation & document layout* and *Multimedia-select/delete/crop/copy media* the ICT Item loaded strongly on more than one component indicating its importance to more than one skillset. With further research and a more intensive data gathering process I believe that these *outliers,* by cross-loading on more than one item or on a non-traditional item, could indicate the cross-purposing and/or inclusion of emerging ICT. This would be valuable information for educators wishing to place their teaching in the forefront of digital learning.

Table 25: *SurveyHE* Principal components Rotated Matrix Eigen .4 = 65.15% Variance

ICT Item Sorted by Subgroup	Word Processing	Spreadsheet	Research & Data Offline	Research & Data Online	Interactive Application
Word processing-select/highlight/cut/copy/paste	.543				
Word processing-create text boxes/borders/columns	.390	.493			
Word processing-reference/thesaurus/language tools	.327				
Word processing-page orientation & document layout	.388		.354		
Multimedia-clear/concise/logical presentations	.670				
Multimedia-effective presentation design/layout	.695				
Multimedia-graphics/clip art/images in presentations	.673				
Multimedia-select/delete/crop/copy	.709	.312			
Hardware-PCs & laptop	.443				
Hardware-USB & file storage	.554				
Hardware-print/copy/scan	.438				
Spreadsheets-terminology: column/row/cell		.873			
Spreadsheets-alignment/adjust column/rows		.864			
Spreadsheets-generate graphs/charts		.799			
Spreadsheets-formulae & basic calculations		.868			
Research & data-advance search subject/key word/author			.883		
Research & data-select search sites/accurate information			.832		
Research & data-record/catalogue/cite references			.780		
Research & data-terminology: fields/records				.831	
Research & data-sort data, add/delete records				.827	
Research & data-uses hyperlinks & navigation				.854	
Interactive applications-3D animation					.652
Interactive applications-ESL & translation					.545
Interactive applications-mapping & GPS					.537
Interactive applications-social media					.535
Interactive applications-web design					.621
Hardware-tablets					.443
Hardware-webcams					.540

Limiting the number of components (5) upon which the ICT items could load was determined by the

SurveyP-12 PCA. For *SurveyHE* this configuration resulted in accountability for 65.15% of the variance, an acceptable percentage when the overall uniformity of responses was indicative of consistency. Once the individual survey analysis was completed, these principal components were compared with the principal components extracted from the *SurveyP-12* data to expose the Academic ICT Gap. (See Appendix 10: *SurveyHE* Principal Components Analysis Total Variance Explained)

5.2.4 *SurveyHE* analysis of interviews and email commentary

Question 30 of the *SurveyHE* offer a follow-up interview option. Fourteen interviews were scheduled and 5 were conducted by emailing the respondent a set of written question based on my review of their survey responses. Most of these questions were clarifications or what I perceived as inconsistencies in their survey responses. Organizing the interview responses for analysis naturally developed along lines similar to the survey questions themselves. Regarding the text responses to the *SurveyHE* ICT questions 18-28:

- Q18 – Q27 listed specific ICT items for their ranking and recommendations
  A. These instructors indicated their approval of this thesis research in a number of ways. They expressed the importance of the formatting and production skills in order for students to present their knowledge in an academic context. They emphasized that though they often provided remedial ICT instruction in class they were much too busy to address student needs with any real consequence. They advised students to prioritize L/CMS skills as they, too, required a proper format to correctly present knowledge. A lack of basic ICT training was seen not only in the foreign students but in the domestics as well. One controversial comment made by four of the respondents was that their younger teaching colleagues did not seem to have well-developed ICT skills. They attributed this to the use of part-time instructors who were not invested in their university work to the level that encouraged them to learn the necessary ICT. Another speculated that as the elder members of the digital native generation, these colleagues, similar to their students, did not have basic ICT instruction in their P-12 educations. A third opinion was that more young instructors are the products of foreign education systems where ICT was not prioritized.
- Q28 asked their preference, use and experience with different operating systems
  A. All four OS were familiar to these respondents who had used each of them for specific purposes in their personal and professional past. Their current uses were determined more by their working needs than by preference. But they moved freely between the different OS. They felt that students should not learn one OS to the exclusion of the others. Finally, they agreed that OS would soon be of little concern as most applications would soon be transportable among all OS.

In summary, these responses were offered in part because the respondents were in agreement with this research study: it was *preaching to the choir.* They all had developed teaching coping mechanisms for dealing with students' lack of ICT performance. But none were happy with the process or the outcomes. The incidence of young colleagues without academically advanced ICT is disconcerting and places additional emphasis on the need to address this issue in a timely manner.

University respondents were overwhelmingly digital immigrants who they rated themselves as competent ICT users and held students to high standards of ICT performance as well. This was an unexpected, grounded-theory-driven, observation. It has been assumed that generational divides would translate into technological divides and that the extent to which this may be true could be a major influence of educational ICT integration patterns. Instead, this data, in agreement with other critical analyses, refutes the generational divisions. It suggests that in every segmented group there exists the range of adaptive personalities: from abhorrers to the inquisitive, experimenters and acceptors. It is the same with ICT across all age and interest groups, a finding that was reflected in the data from this study. In a study that examined the incidence of risk-takers among teachers charged with integrating ICT into their curriculum, there was the same range of representation as in any demographic group (Howard, 2009, p. 93). The idiosyncrasies that influence educators' ICT use are inherent and not age-dependent.

5.2.4.1 Leximancer concept map and Pathway

Leximancer analyzed over 6,000 words of text from 12 *SurveyHE* respondents. All researcher text was removed and the raw text data produced a concept map of the commentary. Seven major concepts housed in 4 dominant themes or categories were detected. The dominant themes, indicated by the largest bubbles in Figure 8, were *computer, ICT, program* and *skills*. A Pathways line was generated to show the most proficient connections between two points or terms. Two concept-terms critical to this research were selected, *skills* and *need,* as the start and end points. The dark arrow, or Pathway, indicates a directional relationship between these two words. Similar to the *SurveyP-12* data, these two critical concept-terms connected through *ICT* and *learning*. The application provided the percentages of accountability (total 100%) of each step along the pathway: student to ICT (.37%); *ICT* to *learning* (.47%) and *learning* to *need* (.17%). The university instructors' responses indicated that their students *need* to *learn ICT* which indicates that they do not arrive at university with these skills. Figure 8 shows the concept map highlighting the 5 dominant themes and the indicative Leximancer Pathways arrow connecting *students* to their *ICT needs*.

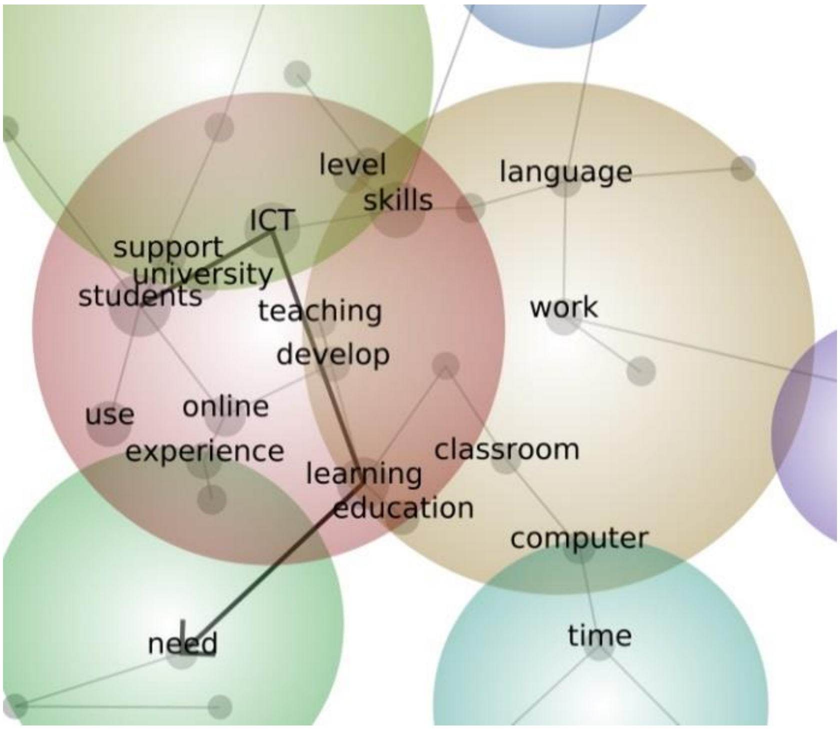

Figure 8: Leximancer concept map of *SurveyHE* respondent interviews and email comments

5.2.4.2 *Ranked individual and compound concepts for categories*

Leximancer provided data tables sorted by both individual and compound concept strengths. In the individual concept table the prominence rating is calculated by measuring the combination of the concept's strength of use and the relative frequency of occurrence in the text block. Table 26 indicates the full range of prominence statistics. The most noted category/concept combinations are indicated in RED.

Table 26: Ranked individual concepts for categories

Category	Concepts						
	important	*L/CMS*	*need*	*online*	*requires*	*research*	*use*
computer	0.0	0.0	1.8	1.7	5.5	0.0	0.0
ICT	0.0	0.0	3.7	0.0	0.0	0.0	1.7
program	1.1	0.9	1.8	0.0	1.8	0.9	1.4
skills	5.3	3.2	0.7	0.7	4.3	4.3	1.3

Table 27 indicates the prominence rating of certain concepts when partnered with other concepts. Leximancer generated 7 concept combinations in three of the four categories. Strong relationships exist between the terms *ICT, L/CMS, need, important, research* and *skills*. Combinations of concepts will only occur in a given category if warranted by the relative frequency and the strength of the indicative combination resulting in a prominence figure >0.1. The most noted concept combinations are indicated in RED.

Table 27: Ranked compound concepts for categories

Concept Combinations	Categories			
	computer	*ICT*	*program*	*skills*
important & LCMS				88.4
need & important		25.4		
need & use		6.3	38.0	
research & LCMS				35.3
use & LCMS		9.5		
use & online				6.9

Interpreting the prominence statistics in relation to the concepts and categories generated indicates that L/CMS skills are extremely important in particular for use in research areas; the ability to use ICT is important; and, programs that develop these skills are of value. See Appendix 20: *SurveyHE* Leximancer Data)

5.3 Exposing the Academic ICT Gap by comparing surveys' analyses

Research question 3 asks: **What is the nature and extent of the Academic ICT Gap between the ICT skills of a non-Western-educated P-12 student and the ICT skills required to undertake a Western university program.** Thus far, the analysis process had prioritized two distinct areas: the ICT skills required for university study and the ICT skills that might be expected from foreign commencing students. This was achieved by conducting independent median, frequency and components analyses. Both surveys presented valid, defensible statistics that allowed the process to procede to comparative analyses that would indicate the Academic ICT Gap.

5.3.1 Independent *t*-Test comparing surveys' means and frequencies statistics

The Dual-Sample Independent *t*-Test was conducted and the group statistics compared to indicate the difference in the importance of the ICT items to the two survey groups. The mean range for *SurveyP-12* is 1=No Opinion; 2=No (student will not have these items); 3=Yes (students will have these items). The mean range for *SurveyHE* is 1=No Opinion; 2=No (student are not expected to have these items); 3=Yes (students are expected to have these items). In Table 28 the higher the mean figure for each survey indicates that the respondents placed importance on the item. The highest mean figures (>2.50) in each column is indicated in RED. This comparison analysis is the first indication of the difference between the ICT skills universities require and the ICT skills the commencing student might bring with them to their higher education. These mean figures confirmed considerable discrepancies between the university respondents' needs and the student-acquired skills. Table 28 compares the means statistics of the two surveys sorted by the means difference.

Table 28: Dual-Sample Independent *t*-Test group means statistics

Dual-Sample Independent *t*-Test Mean Comparison	*SurveyP-12* Mean	*SurveyHE* Mean	Means Difference
Hardware-PCs & laptop	2.08	2.96	0.88
Research & data-terminology: fields/records	2.34	2.94	0.60
Research & data-uses hyperlinks & navigation	2.38	2.93	0.54
Hardware-print/copy/scan	2.25	2.76	0.51
Hardware-USB & file storage	2.35	2.82	0.48
Spreadsheets-generate graphs/charts	2.20	2.62	0.42
Spreadsheets-formulae & basic calculations	2.19	2.60	0.41
Spreadsheets-terminology: column/row/cell	2.27	2.67	0.40
Research & data-record/catalogue/cite references	2.43	2.75	0.32
Spreadsheets-alignment/adjust column/rows	2.28	2.49	0.21
Word processing-select/highlight/cut/copy/paste	2.68	2.88	0.20
Word processing-reference/thesaurus/language tools	2.50	2.68	0.19
Word processing-create text boxes/borders/columns	2.63	2.81	0.18
Multimedia-graphics/clip art/images in presentations	2.68	2.84	0.16
Word processing-page orientation & document layout	2.60	2.70	0.10
Research & data-sort data, add/delete records	2.34	2.43	0.09
Multimedia-effective presentation design/layout	2.59	2.68	0.09
Multimedia-select/delete/crop/copy	2.61	2.69	0.09
Research & data-advance search subject/keyword/author	2.51	2.58	0.07
Hardware-webcams	2.05	2.11	0.06
Research & data-select search sites/accurate information	2.47	2.47	0.00
Interactive applications-social media	2.32	2.25	-0.07
Multimedia-clear/concise/logical presentations	2.70	2.63	-0.07
Hardware-tablets	2.51	2.15	-0.36
Interactive applications-web design	2.43	1.98	-0.45
Interactive applications-ESL & translation	2.49	1.92	-0.57
Interactive applications-3D animation	2.48	1.89	-0.58
Interactive applications-mapping & GPS	2.55	1.95	-0.60

5.3.2 Mann-Whitney U non-parametric testing indicates an Academic ICT Gap

The Mann-Whitney *U* test was chosen as the proper analytic tool because it accommodates small sample numbers and two independent variables. The distribution data of the two independent variables, International teachers and university educators, was conjointly analyzed using the 28 dependent variables (ICT items). The critical assumption that determines how the results of the Mann-Whitney *U* test is interpreted is that the two independent variable groups have similar distribution patterns, though these distribution patterns may occur in different areas. Analysis results indicated that the null hypothesis (that the distribution is the same) be retained for 9 of the questions. The null hypothesis was rejected for the remaining 19 questions indicating they were statistically significant. Visual inspection indicated acceptable distribution patterns however, numerical data was erratic. This combination of factors suggested further analyses focus on comparing *mean* data and aligning response frequencies. The validity for this was established by the consistency of the distribution patterns. A small number of outliers were noted for closer observation in the subsequent testing. Table 29 displays the results of the Mann-Whitney *U* test sorted by the Asymp. Sig. *p* values. Which also indicates the items to be retained and those that should be rejected.

Table 29: Mann-Whitney U Null Hypothesis Test results

Mann-Whitney U Null Hypothesis Test	M-W *U*	Asymp. Sig. *p*	Hypothesis Decision
Research & data-sort data, add/delete records	22432	.738	Retain
Hardware-webcams	20954	.570	Retain
Multimedia-select/delete/crop/copy	21179	.310	Retain
Research & data-uses hyperlinks & navigation	20778	.261	Retain
Research & data-terminology: fields/records	21710	.220	Retain
Interactive applications-social media	19972	.195	Retain
Multimedia-effective presentation design/layout	20895	.150	Retain
Multimedia-graphics/clip art/images in presentations	20697	.111	Retain
Word processing-page orientation & document layout	20225	.073	Retain
Spreadsheets-alignment/adjust column/rows	19511	.011	Reject
Word processing-create text boxes/borders/columns	19128	.005	Reject
Multimedia-clear/concise/logical presentations	19353	.001	Reject
Word processing-reference/thesaurus/language tools	19188	.001	Reject
Hardware-tablets	16852	.000	Reject
Word processing-select/highlight/cut/copy/paste	19410	.000	Reject
Spreadsheets-formulae & basic calculations	16022	.000	Reject
Spreadsheets-terminology: column/row/cell	16658	.000	Reject
Research data-advance search subject/key word/author	16828	.000	Reject
Interactive applications-web design	14585	.000	Reject
Spreadsheets-generate graphs/charts	16058	.000	Reject
Interactive applications-ESL & translation	12905	.000	Reject
Interactive applications-mapping & GPS	12672	.000	Reject
Interactive applications-3D animation	13099	.000	Reject
Hardware-USB & file storage	14659	.000	Reject
Hardware-print/copy/scan	14227	.000	Reject
Research & data-record/catalogue/cite references	13670	.000	Reject
Research & data-select search sites/accurate information	12856	.000	Reject
Hardware-PCs & laptop	8158.5	.000	Reject

5.4 Chapter summary

Computer technology has brought challenges and solutions to learning. There is commonality of ICT skills between the International teachers and the university instructors. However, these skills are taught in an erratic construct with questionable regard for student learning across the scope of the educational experience. A simplified, comprehensive ICT integration plan is needed to guide international education in the creation of a next-generation global workforce.

6 POSITS, SUPPOSITIONS AND ANALYSES CONCLUSION

"We teach who we are"

(Parker Palmer, Educator, 1991)

The Oxford online dictionary defines *posit* as *a statement that is made on the assumption that it will prove true* (2016). The ability to arrive at a final conclusion, to prove or disprove the existence of the Academic ICT Gap, was the focus of these data research and analyses processes. The assumptions below are based on the literature and historical documents presented in Chapters 1 through 5 and provide substantive support for the existence of the Academic ICT Gap. They are presented here in a support role and with the conviction that further research will prove them true. Chapter 6 reviews these data then presents supporting posits and a final conclusion based upon three research questions:

Research Question 1: **What are the ICT skills of a non-Western-educated P-12 student?**

Research Question 2: **What ICT skills are required to undertake a Western university program?**

Research Question 3: **What is the nature and extent of the Academic ICT Gap between the ICT skills of a non-Western-educated P-12 student and the ICT skills required to undertake a Western university program?**

Answering these questions in a thesis context required review of a range of related topics: International P-12 education and 2nd language learners; historical timelines; cultural and political influences on global education; ICT assessment and remediation strategies; and, parsing the responsibilities of all stakeholders on these important topics. At the most basic level was the need to identify the specific university-level ICT skills expected from commencing students. With this information, an Academic ICT Baseline could be developed and the Academic ICT Gap could to be confirmed. See Appendix 11 to access the abstract of the presentation before the International Conference on Technology in Education at Hong Kong Polytechnic University in 2015 examining the comparison of these ICT skills.

6.1 Deductive posits

The 13 posits that follow are based on historical events, relevant academic literature, popular media reports and observations and a chronicle of educational technology since 1980. Individually they are circumstantial but they are compatible as a body of argument that supports a reasonable suspicion that an Academic ICT Gap exists.

Posit 1: *Some groups limit ICT learning by choice while others users are limited by opportunity and circumstance. Restrictions placed on the latter group should be acknowledged with respect to political, cultural and social norms.* Chapter 1 introduces the possibility of an Academic ICT Gap by examining the various components and participant groups responsible for the availability and integration of educational ICT. This overview reminds researchers that ICT instruction is not universally applicable and that instructional constructs reflect and are responsive to the political, cultural and social norms of the community. In developing countries political, cultural and social norms may contribute to or detract from ICT integration efforts and must be addressed to effect sustainable, positive changes.

Posit 2: *The transition to academic-level ICT is a formidable assimilation issue for commencing university students.* Chapter 1 defines two levels of academic ICT: basic (offline) and advanced (online) skills or RPS common in more rigorous work. L/CMS also adds complexities to the ICT skills students must master and these skills are not new. In 2005, Dabbagh and Bannan-Ritland identified important web-based applications and their associated skills: use browsers and search engines; understand URL configurations; locate websites; navigate through hyperlinks; evaluate web content; download and install plug-ins to view multimedia files; use tools that enable asynchronous and synchronous communication; and engage in collaborative and distributed learning activities.

Posit 3: *P-12 Inherent inconsistencies make it difficult to coordinate educational policies and procedures among International P-12 institutions.* International P-12 schools and educational service providers are impacted by: unprecedented demand for growth; the addition of new courses and programs; inconsistencies in instructional oversight; the need for recognized governance; and a lack of teacher-training relevant to the international market. These barriers prevent International schools from achieving equity with domestic counterparts.

Posit 4: *Academic administrators default to traditionally cautious business models that restrict speculative ICT decision due to a lack of critical, precedential data.* Chapter 1 questions the ability of academics and governmental institutions to bring about sustainable, systemic change in higher education without changing their traditional business models, motivations and perception of student needs. Though these public sectors seem slow to implement change, pressure from the private sector in need of a global workforce may prove an effective motivation.

The Academic ICT Gap

Posit 5: *Performing important academic functions, such as using L/CMS and conducting rigorous research, are negatively impacted by the students' lack of e-learning competencies.* Competencies are clusters of related knowledge, skills and abilities that correlate with effective performance in the task or role at hand. Critically, competencies are measurable and can be developed and improved (Parry, 1998). Through formal training or self-teaching, students are expected to develop L/CMS and other e-learning competencies immediately upon commencement. But in order to develop and improve competencies a cluster of related knowledge must be in situ. University performance indicators should be established and monitored to determine the long-term effects of diminished student competencies.

Posit 6: *The International marketplace require a global workforce with escalating professional ICT skills and this need underwrites commercial support of higher education.* The private sector needs students trained in traditional ICT for sales and communications and emerging ICT for long-term innovation and investment. When skills are not evident in graduates, businesses must develop relevant training programs. However, these ICT skills are common to both academia and commerce and pre-employment training of ICT skills mutually benefits students and their academic research institutions.

Posit 7: *To counter becoming remedial institutions, universities should set and maintain a standard of high academic-level ICT performance that supports the rigorous research upon which their institutions rest.* Universities live and die by the quality of their faculty – faculty attracts students and funding and generates top rankings. These faculty need to attract quality students able to assist and publish rigorous research (Tappscott & Williams, 2006, p. 177). Until the Academic ICT Gap is recognized and its effect on all levels of higher education is determined, university students will continue to expect their instructors to remediate their lack of ICT and RPS skills.

Posit 8: *It is reasonable to assume that ICT integration varies country-by-country.* In Chapter 2 the context of this Academic ICT Gap research is chronologically examined: comparing the national development of computer and digital technology in developed (primarily Western) countries with developing (primarily Eastern) countries. Based on this historical record, it is unlikely that uniform ICT integration has taken place across disparate countries. This theory is supported by global humanitarian and non-governmental organizations such as UNESCO who have monitor global change in technology development over many years.

Posit 9: *Providing instruction in the use of ICT tools supports other curriculum areas important to the foreign student, such as 2nd language learning*. Multimedia and other ICT offer tools and options to help close linguistic gaps between disparate languages such as Chinese and English. The use of ICT in language learning has been standard to Western education for many years.

Posit 10: *It is reasonable to expect commencing university students to have inconsistent P-12 ICT educations.* Chapter 2 presents Western educational enrollment statistics based on the origins of the 2013 foreign student populations and governmental growth indicators of their percentage in future enrollment. Together, these findings indicate that as products of developing countries, the majority of the non-western-educated foreign students might be expected to have received minimal ICT experiences in their P-12 educations.

Posit 11: *(a) Computer technology was invented by economically-developed, first-world countries, (b) Computers "speak English" (HTML), (c) Western universities were the first public institutions to use computers, and (d) ICT have become ubiquitous in Western education.* These four prima facie statements equally effect: developed and developing economies, Eastern and Western higher education, the growth in the importance of mastery of ICT skills, and the linguistic challenges a foreign student faces in the west.

Posit 12: *Modern Chinese education post-Cultural Revolution, has roots in a traditional respect for education continues to be a vehicle of social and political change.* Chinese domestic schools have lofty goals for ICT integration but have yet to make the sweeping improvement that the government recognizes are needed.

Posit 13: *International schools are experiencing uncontrolled growth and systems that might provide governance and oversight are not yet in place.* International schools are opened and International staffs hired without having in place the traditional controls and oversight that monitor their performance and accountability as one would find in domestic schools.

6.2 Analyses results

The following 8 results were derived from the analysis process. In conjunction with the 13 posits stated above they form a body of evidence that supports the existence of the Academic ICT Gap. Analyses were conducted independently on *SurveyP-12* and *SurveyHE*. The raw data was then combined and reanalyzed to identify existing discrepancies.

6.2.1 *SurveyP-12* analyses results

Result 1: *Analyses of the median values, variability, the chi-square goodness-of-fit Asymp. Sig. levels and Cronbach's alpha, determined that the data set has a high incidence of internal consistency with* *questions that are closely related as a group and therefore are highly reliable.* These results indicate that there is a valid reason to investigate the ICT skills of this random student cohort if we expect it to develop cohesion and become a functioning member of the academic community.

Result 2: *Exploratory factor analysis residual correlation matrix (.623 to .805) indicated all 28 observed variables have solid relationships. This was further indicated by the Kaiser-Meyer-Olkin Measure of Sampling Adequacy of 0.899, well within the meritorious range*. Bartlett's Test of Sphericity confirmed that the data set is appropriate for component analysis. Outliers were observed and noted for future monitoring. The analyses to follow did not identify any new outliers and the strength of the KMO results supported acceptance of the results.

Result 3: *The 28 ICT items questioned in this survey consistently loaded in their respective groupings with slight variations indicated for emerging ICT and digital content.* The principal components analysis critical Eigen factor (>0.4) produced a strong relationship between items which loaded on 5 components and account for over 80% of the item variance. These figures indicate an incidental but interesting correlation pattern between ICT items not usually associated with each other. Further analyses, focused on emerging ICT and differentiating by fields-of-study, should look for unusual ICT item combinations that may provide insights into developing and emerging RPS skills.

Result 4: *Leximancer analysis confirmed the relationship of specific vocabulary and terms the International teachers chose in dialogue with each other to describe their comparative experiences in ICT education.* Leximancer analysis of *SurveyP-12* unsolicited comments reinforces the quantitative analysis results above.

6.2.2 *SurveyHE* results

Result 5: *Analyses of the median values, variability, the chi-square goodness-of-fit Asymp. Sig. levels and Cronbach's alpha, determined that the data set has a high incidence of internal consistency with questions that are closely related as a group and therefore are highly reliable.* Again, these results indicate that there is a valid reason to investigate the ICT skills of this random student cohort if we expect it to develop cohesion and become a functioning member of the academic community.

Result 6: *Exploratory factor analysis residual correlation matrix (range .363-.876) indicated that all 28 observed variables had solid relationships. This was further indicated by the Kaiser-Meyer-Olkin Measure of Sampling Adequacy of 0.857, well within the meritorious range.* Outliers were observed but noted for future monitoring as Bartlett's Test of Sphericity confirmed that the data set was appropriate for component analysis. No additional outliers were generated in further analyses.

Result 7: *The 28 ICT items questioned in this survey consistently loaded in their respective groupings with slight variations that may indicate emerging ICT and digital repurposing.* The principal components analysis critical Eigen factor (>0.4) produced a strong relationship between items and over 65% of the item variance was accounted for by this component configuration. These figures indicate that while the variance of 65% is acceptable other variables must be incorporated with this PCA to assure adequate representation of all relationships.

Result 8: *Leximancer analysis confirmed the relationship of specific terms the respondents chose to describe their personal and professional experiences in ICT education and their concern that students were not receiving relevant ICT instruction.* Leximancer analysis of *SurveyHE* unsolicited comments and conversations reinforces the quantitative analyses results above.

6.2.3 Comparative analysis results

During individual analyses, both surveys continued to present defensible statistics that allowed the analysis process to move forward. To conduct a dual-analysis the raw data from the two surveys were combined. The Mann-Whitney *U* analysis indicated that the null hypothesis (that the distribution is the same) be retained for 6 of the questions. The null hypothesis was rejected for the remaining 22 questions indicating they were statistically significant.

6.3 Chapter summary and answers to thesis research questions

Thirteen deductive posits and eight measurable results were drawn from the thesis' first five chapters. Additionally, the Leximancer analysis confirmed the relevance of interviews, text data and unsolicited commentary. The final step in this process, the Mann-Whitney *U* analysis, compared the 28 dependent variables (ICT items) in relation to the two independent variables (university instructors and International teacher responses) and established the dominance of each set of ICT items in relation to the whole.

Research Question 1 *What are the ICT skills of a non-Western-educated P-12 student?*

Result: Dual-sample independent t-test shows that International teachers estimate students to have experience in 11 of 28 ICT items (≥2.5 on a scale of 3.0).This is significant as it indicates a very low incidence of ICT items in the foreign students educated in a non-Western P-12 school.

Research Question 2 *What ICT skills are required to undertake a Western university program?*

Result: Dual-sample independent t-test shows that university instructors highly value (≥2.5 on a scale *of 3.0)18 of 28 ICT items. This is significant as it indicates a high-level of expectation for a range of ICT items in order to assure successful university study.*

Research Question 3 *What is the nature and extent of the Academic ICT Gap between the ICT skills of a non-Western-educated P-12 student and the ICT skills required to undertake a Western university program?*

Result: The 11 ICT items foreign students have experienced do not include the 11 of the highly valued ICT items required by university instructors. An Independent *t*-Test indicates that c*ommonalities of skills levels may exist in 9 of the 28 ICT items*. This is significant in that it identifies specific ICT item discrepancies as well as indicating new areas for further investigation and research.

Analyses Conclusion: Non-Western-educated P-12 students cannot be expected to have experience with approximately 50% of the 28 ICT items deemed *important* by university instructors for the successful completion of a higher education program. Discrepancies exist in the rigorous performance areas of *research and data collection, spreadsheet and calculation skills, advanced word processing* and *multimedia production.* Research further indicates that the ICT items in which the foreign-educated students excel, such as *social media, ESL* and *GPS* are conversely valued by university instructors and are not used at this time to enrich the foreign students' learning experience to any measurable degree.

7 INSTRUCTION THAT SUPPORTS SEAMLESS INTEGRATION

"The future cannot be predicted, but futures can be invented"

(Denis Gabor, Nobel Award in Physics, 1963, p. 207)

The historic record indicates that the Academic ICT Gap developed through oversight and was not perpetrated by direct intention. It simply reflects years of differing geographic, political and socially-influenced educational scenarios. Historical data indicates that computers developed into such powerful instruments with such far-reaching effects that achieving educational integration, initially considered a simple task, quickly became difficult. In some cases, the early computers' strongest proponents; scientists and mathematicians who understood the new technology, unintentionally misrepresented the simplicity of the machines. Digital technology integration challenges were substantial: infrastructure, training, support, security requirements, non-existent curriculum, social norms and political influences among others. As with all new knowledge, learning strategies and learning styles influenced user acceptance of the new technology. *Learning* the computer was both difficult and time-consuming and the general public did not find early computers to be user-friendly. Adopting and adapting to the new computing technologies, teachers and students were required to develop new manipulative skills. When the Internet was introduced, all the information in the world became available. Educators and students were overwhelmed with the possibilities. Post-Internet, many teachers focused on integrating multimedia, taking the best of the online world and creating curriculum to fit. Online learning was fun: incorporating sound and video with immediate-response reinforcement. Students were introduced to mobile phones, tablets and other hand-held hardware that developed the *fast fingering* that would come to represent the Internet age. Over time, basic offline ICT and the requisite keyboard skills, difficult to master and much less colorful, were marginalized, even though they remain central to academic rigor and a commercially viable global workforce.

7.1 Integration timelines drive the ICT intervention process

Three scenarios are provided for immediate, intermediate and long-term ICT intervention that will achieve substantial integration in a predictable time-frame and begin closing the Academic ICT Gap.

7.1.1 Targeted Active Integration

Targeted Active Integration involves committing resources across specific sectors for a short but intensive time period. It is appropriate to upgrade ICT skills for grade 11-12 students who will be entering universities and vocational training. Targeted Active Integration begins with an Academic ICT Baseline pre-assessment survey of teachers, advisors and administrators. This data underpins: a structured professional development program for teachers; an intensive daily training ground for students; and a guide for integration needs and decision for administrators. This immersion approach produces measurable integration changes within one academic year. In addition to traditional or basic ICT skills, L/CMS are introduced using higher education resources. University-level online learning models are included at every possible opportunity. Targeted Active Integration can serve as the first step in developing a campus-wide integration plan. Collaboration with professionals in ICT integration who can bring objectivity to the assessment and training program is recommended.

7.1.2 Active Integration

Active Integration involves committing resources across all campus sectors for a period of at least one year. Active Integration is similar to Targeted Active Integration in structure and goals. However, it is a whole-school program. Active Integration requires a longer time period as there are more personnel and students to be trained and additional curriculum modifications required. Developing a full-scale L/CMS experience for teachers and students is one of the Active Integration goals. L/CMS and purposeful online learning programs are developed for core instruction. Again, collaboration with professionals in ICT integration and regular monitoring by an ICT integration specialist or consultant brings objectivity to the assessment and training processes is recommended.

7.1.3 Managed Seamless Integration

Managed Seamless Integration involves whole-campus commitment that scaffolds ICT integration planning over a period of academic years. It requires all teachers and staff to have basic ICT skills in place and an infrastructure that supports rudimentary campus-produced L/CMS and online programming. Managed Seamless Integration begins with an Academic ICT Baseline pre-assessment to develop effective professional development for staff and administrators who collaborate to achieve horizontal and vertical integrate ICT across all curriculum. Once a program is in place, students are trained in a semi-emersion process at all grade level regardless of previous or past ICT experience. L/CMS and online learning of both core and enriched curriculum are included. Developing a full-scale L/CMS program is integral to Managed Seamless Integration goals. This method is similar to the maintenance management that follows a Targeted Active Integration or Active Integration program (Price, 2005).

7.2 *Project IF:* Instructional System Design counters the Academic ICT Gap

For the purposes of this study the P-12 classroom will serve as the prototype for examining the structure of an instructional design that target closing the Academic ICT Gap.

Project IF: Ideas for the Future is an instructional system designed to teach a broad range of ICT skills relevant to both academics and education. Based on the cooperative values and standards of a small business model, *Project IF: Ideas for the Future* has been taught for over 10 years in classrooms in the UK, the USA, and China (Price, 2005). The program is inclusive and relevant instruction can be developed appropriate to learning level, content, context and age group, from middle-school through corporate training programs. The *Project IF: Ideas for the Future* structure consists of:

1. pre-assessment;
2. creation of participant divisions based on indicative skill levels;
3. program development for each participant division with appropriate learning outcomes;
4. relevant curriculum identified and ICT seamlessly integrated;
5. formative assessments to maintain current levels and introduce new ICT skill.

7.2.1 Pre-Assessment

Generalities: Crafting a successful ICT integration or remediation plan requires a comprehensive overview of the current ICT levels at play. Achieving universal use of all ICT is not a practical goal. ICT skills should be assessed horizontally and vertically and include administrators, teachers and students, according to the digital demands of each position. If we assume that some ICT skills are lacking in all ICT practitioners then a comprehensive tool that identifies these gaps across all academic groups will determine the starting-point of a targeted ICT remediation program. Selecting or developing the correct assessment tool for a particular study requires measurable analysis of the needs of all users.

Specifics: ICT skills assessment should be both summative (pre- and post-assessment) and formative (ongoing monitoring of learning and retention). Formative assessment provides a comprehensive picture of individual student's skills allowing for flexible modification of expected tasks. Project-based learning is the preferred assessment format. However, when using project-based curriculum, the assessor must be adequately trained to detect different skill levels and in the use of a range of appropriate tools and observational methods that isolate embedded skills. Practical considerations, course length, structure, student maturity, entry skills level, available technology and supporting infrastructure help determine the appropriate assessment tools. A range of assessment tools are readily available and many have been adequately field-tested. See Appendix 12 for a list of the best-practice criteria of the formative assessment structure; an explanation of the rationale in the structure and an example of a current assessment tool that demonstrates this is provided by Partnership for 21st Century Skills e-paper (2006, p. 5). Appendix 13: ICT Integration Survey - teachers and staff, provides a sample Academic ICT Baseline survey designed to assess ICT skills of campus staff, administrators and teachers. This survey is the first step in developing an overall instructional program. They are bespoke, intended for internal guidance, conducted online and offer anonymity to all respondents. Administrators and officials in charge of ICT procurement should be encouraged to participate at this level in order to gather valid data on the overall level of ICT campus competency.

7.2.2 Participant division

Generalities: This research indicates that while students are the most in need of immediate ICT basic training there is a need to address the ICT skills of other public and private stakeholders. The ICT skill range of potential participants is inclusive as a growing number of teachers and students have passed through P-12 educations programs during the time that basic ICT instruction was marginal. These instructors may share the same ICT limitations as their students. This speculation was expressed in the unsolicited comments made by both survey groups. Respondents felt that their P-12 domestic students as well as younger university instructors from both developed and developing countries were far behind in their ICT production skills. This indicates that educators and administrators, young and old, may have disparate ICT experience and all ages would benefit from continued ICT assessment and training.

Specifics: Students, teachers and administrators involved in P-12 education are given Academic ICT Baseline surveys. From this data instructional groups appropriate to age and experience are created. Horizontal and vertical alignment of learning outcomes are stated, timelines created that reflect realistic goals, curriculum designed and plans to monitor outcomes for each participant group developed.

7.2.3 Instructional programs that achieve intended learning outcomes

Generalities: Authentic Instructional Systems Design with seamlessly integrated ICT skills, is a valuable component of the life-long learning construct. ICT integration has changed the role of the instructor from primary knowledge source to knowledge facilitator (Steffey, 2001, p. 1). The teacher's role of imparting hidden knowledge is replaced with creating effective instructional design processes that develops the student's self-discovered knowledge. Within the context of creating effective classroom curriculum, the instructional designer must be aware of the:

- outcomes to be achieved

- range of options available to meet stated outcomes
- adaptations required to address the detected learning styles
- scaffolding that accommodates detected learning styles
- cross-curricular options available for formative assessment of student learning

While learning outcomes and assessment goals can be quantified, it is experience and experimentation that provide teachers with the skills and confidence to correctly assess student learning styles and to create learning opportunities that address them. Effective ISD must:

- satisfy both subjective and objective criteria
- be flexible under review and revision in response to student performance
- achieve seamless ICT integration across all curriculum
- incorporate emerging ICT in appropriate ways, such as delivery methods
- scaffold production skills by applying them to relevant topics and subjects

The instructor's understanding of the subjective interest of the students has great relevance in providing the motivation that keeps this process relevant and engaging.

Specifics: The following three levels are based on *Project IF: Ideas for the Future*: ISD prepared for Active Integration in relevant P-12 instruction: the optimal grade levels for the maximum return on ICT integration efforts. Students, like their instructors, invest time and energy into developing skills for which they can identify a need or use. ISD is integrated into traditional core-curriculum or developed as an independent program: responsive to assessment indicators and student needs. Embedding ICT into core work is preferable as it does not introduce additional work but supports the institutional programs already in place. The process begins offline but limited Internet access will be needed for student skills development into mid-level coursework. Levels One and Two are appropriate for P-12 education. Level Three would be appropriate for STEM related P-12 courses and for university preparation according to field of study.

Level One: The focus of ISD Level One is to establish basic ICT skills through applications such as MS Office Suite's Word, Excel and PowerPoint, and the Adobe Creative Suite's Photoshop and Illustrator applications. Internet research and email communications are an integral component of the course curriculum. Most Western P-12 students must successfully complete a basic ICT course towards graduation credit. Skills mastered in technology courses are ideally used to digitally produce work in other classes. In this support context, students develop basic cognitive, affective and psychomotor skills on which later courses will build. Instructional design for Level One coursework is the easiest to create as considerable research on teaching and assessing basic offline application skills are in place. However, the foci of post-Internet research tends towards emerging applications, for good or for bad, as they are introduced. Level One underpins all Level Two and Level Three coursework. The Expectations, Themes, Learning Strategies and Applications are reoccurring in all levels. The projects are designed for equal effectiveness as individual coursework or core curriculum.

Level Two: ISD Level Two reinforces previous skills while introducing the 2D and 3D design, animation applications such as 3D Max and Maya; audio/video manipulation programs such as Adobe Premier and iMovie; and, web-development tools such as the Adobe Cloud Suite. Internet research, email communications and an overall awareness of effective web-based design are all components of the ISD curriculum. This coursework is designed to emotionally engage students while developing higher thinking skills. Curriculum should encourage students to reflect and record their real-world experiences in a digital format. Instructors must be sufficiently trained: able to create diverse and exciting projects that will teach advanced thinking skills while creating an enriched environment. This is the level at which students productively interact with institutional L/CMS as they employ their individual learning styles and develop self-regulated learning. As with Level One, Level Two Projects are designed for equal effectiveness as individual coursework or core curriculum. A combination of Level One core-curriculum integration followed by Level Two specificity is another integration variation.

Level Three: ISD Level Three reteaches previously learned applications by continuing to personalize the instruction: adding advanced web-design strategies to the skills introduced at the intermediate level. Level Three is based on the student's individual interests, field of study, academic and career goals. Students develop the technology and cognitive skills required for entry into the workforce and university-level education. To be successful, they should be highly motivated and invested in acquiring real-world experience. The Internet, ICT and web design concepts are the daily working tools of this curriculum. ISD for this coursework develops advanced technology and thinking skills and introduces the concept of acceptable social interaction and teamwork in a multicultural business environment as dictated by industry-accepted criteria. Individuals or groups of students propose a project based on a marketable real or virtual product or service and submit an outline taking the project from conception through completion. These proposals demonstrate creative application of the ICT skills acquired in the previous two levels. Not all skills need be included in this final proposal. Students' interest areas from Level One and Two are developed here in greater depth. Projects are self-designed and directed from conception through production by the student with periodic formative assessment that adheres to learning outcomes. Emphasis is equally on skills demonstration as on professional performance within the group dynamic. Students will bring high motivation, work ethic and an interest in working within a pseudo-business environment. Instructors must be adequately trained, knowledgeable and current about the needs of the global marketplace. Guidance is focused on theoretical knowledge and application as students exercise their individual use of attained ICT skills. Table 30 presents the expectations and outcomes of the escalating coursework for Levels One, Two and Three (Price, *Project IF: Ideas for the Future*, 2006).

Table 30: Project IF: Ideafor the Future - Level One, Two and Three

	EXPECTATIONS	THEMES	LEARNING STRATEGIES	APPLICATIONS	PROJECTS
Level One	▪ Business applications that manipulate and present written and numerical data teaching the appropriate combinations of office skills. ▪ 2D & 3D multimedia applications that teach a range of special effects and transfer skills.	▪ Bloom's Taxonomy concept and vocabulary development ▪ Paper and digital recordkeeping ▪ Understanding hardware, software and digital systems ▪ Apply of usability and critical analysis ▪ Use of businesses' best-practices	▪Teamwork to vary learning opportunities ▪ Peer tutoring and online tutorials ▪ Whole-class presentations ▪ Peer assessment	▪Alice ▪Audacity ▪Office: Excel PowerPoint Word ▪Google SketchUp	▪Letterhead 4U ▪Family Crest ▪Games ▪Infomercials on BYOD ▪Business Cards ▪Maze
Level Two	▪ Interactive applications that exercise intuitive thinking skills, using navigation techniques and other non-linear interactivity skills.	▪ Design cycle concept and vocabulary development ▪ Paper and digital recordkeeping ▪ Understanding hardware, software and digital systems ▪ Apply of usability and critical analysis ▪ Use of businesses' best-practices	▪Teamwork to vary learning opportunities ▪ Peer tutoring and online tutorials ▪ Whole-class presentations ▪ Peer assessment	▪Audio ▪Ambassador ▪Wiki/Blog ▪Virtual Mapping ▪Radio Play ▪My Fantasy Home ▪Energy Crisis	▪Alice ▪Audacity ▪Office: Excel PowerPoint Word ▪Google SketchUp
Level Three	▪ Website design applications requiring an understanding of usability and design concepts, navigation techniques and the use of multimedia interface. ▪ Demonstrating best-practices of small-business ethics and interpersonal interactions working with colleagues towards productive outcomes.	▪ Bloom's Taxonomy concept and vocabulary development ▪ Paper and digital recordkeeping ▪ Understanding hardware, software and digital systems ▪ Apply of usability and critical analysis ▪ Use of businesses' best-practices	▪Teamwork to vary learning opportunities ▪ Peer tutoring and online tutorials ▪ Whole-class presentations ▪ Peer assessment	▪ Audacity ▪Google SketchUp and Blender ▪Flash and Movie Maker ▪Office: Access, Excel, PowerPoint, Publisher Word ▪ Adobe Creative Cloud Suite	▪Director's Choice – Student designed or group project of marketable quality that takes a product or service from conception to completion.

7.2.4 Seamless integration of ICT production skills

Generalities: Summative data allows instructors to modify curriculum from semester-to-semester, class-to-class and program-to-program to adjust learning outcomes and accommodate extended planning goals. Appendix 14 lists the best-practice criteria of a comprehensive summative assessment structure; an explanation of the rationale in the structure and an example of a current assessment tool that demonstrates this is provided by Partnership for 21st Century Skills e-paper (2006, p. 5).

Specifics: Integration of ICT into classroom practice supports a variety of modes of student learning. Seamless integration of ICT skills supports core curriculum learning and retention by injecting an interactive element that accommodates a range of learning styles and strategies. There is mounting evidence that ICT use allows students to learn in ways that are congruent with their abilities, cultures, backgrounds, learning styles of special needs (Downes et al., 2001, p. 26). Ninety-five percent of the university instructors surveyed for this study believe new ICT skills are easiest and best learned when teaching a purposeful task and that repetition reinforces deeper learning. Computer technology curriculum: coding, technological configurations, hardware and software design, is an instructional domain that can be segmented from ICT instruction. In the P-12 classroom, ICT instruction is the domain of the classroom teacher and is provided in the guise of seamless integration. Once seamless integration is achieved the teaching of ICT skills is self-perpetuated by their repetitive use and application (Price, 2006).

7.2.5 Formative assessment to monitor and maintain ICT skill levels

Generalities: Education is built on a cycle of assessment and remediation. When basic procedures are sidelined, academicians diverge from their own best-practices. However, on the topic of ICT and the internationalization of education, higher education often discounts the input of its own researchers and instructors. “There is still too great a focus on political and economic rationales from an international and institutional perspective, in which the perspective of those for whom it is all intended are underrepresented” (Jones & de Wit, 2012, p. 50). As a matter of best-practices, researchers recommend regular assessment and evaluation of academic ICT used in L/CMS and other transitional areas. (See Appendix 6: Commercial and educational assessment tools)

Specifics: At every instructional level, the challenges of integrating 21st century ICT skills into daily curriculum are surprisingly similar for both foreign and domestic academic administrators. Developing global standards for 21st century ICT skills has brought together a range of humanitarian groups and educational providers. School boards, administrators and financial officers make ICT procurement decisions for their respective schools. Yet, to develop comprehensive plans that consider the needs of future students, these decision-makers require *inter alia,* timely data on ICT use. Universities must initiate sustainable change and influence P-12 integration goals by: crafting an academic ICT Baseline, a dependable research tool that provides continuously current data upon P-12 educators can base ICT planning and skills assessment decisions.

7.3 Emerging ICT challenges static learning practices

Emerging ICT continue to challenge the development of effective learning programs. Preparing students for L/CMS is an example of the difference between what P-12 institutions offer and what universities require. Higher education continues to increase dependence on L/CMS without fully understanding the challenges it presents to present and future students. By comparison to universities, the use of L/CMS at the P-12 level is limited as is the student training in this important learning tool. *SurveyHE* asked respondents to list any emerging ICT they used or intended to use that was not already listed in the previous survey questions. Multiple emerging and bespoke RPS (research production skills) were put forth. Some were cross-platform: listed by more than one person, across different disciplines. Many RPS were academic-based with strong commercial implications. Many were free- or share-ware: cost-effective acquisitions, available to educators and businesses alike. STEM respondents indicated the need for high-level RPS. The advanced nature of the RPS listed by respondents and the importance of the applicable fields-of-study to national and commercial interests reinforces the need for students to enter higher education with well-developed basic ICT skills. It is the RPS not basic ICT that students should develop during their years in higher education. (See Appendix 15: Research Production Skills recommended for higher education)

7.4 Chapter summary and thesis conclusion

"To develop a profile of students' ICT Literacy, and as a way to report ICT Literacy overall and compare different groups of students, six proficiency levels have been defined and descriptions developed to characterize typical student performance at each level of the National Assessment Program (NAP) ICT Literacy assessment" (ACARA, 2014). Thus begins the NAPLAN program that was introduced to 3.6million Australian public-school students in 2014. Because Australian P-12 education prepares the domestic student cohort for the universities polled in this research, this policy is a fitting assessment standard to reference in this conclusion. Like other countries, this was not the first national assessment standard Australia had issued. Some have been successful and others found wanting or overreaching. Many have been altered simply because of rapidly changing ICT. As students and teachers learn and relearn ICT they are the first-in-line to determine their workability and suitability in an educational context. As such they are the *guinea pigs* of adoption and adaptation. Ongoing formative and summative assessment is integral to monitor this adoption and adaptation process upon which each new version of the learning plans and learning outcomes can be based. But this study did not focus on the P-12 student experience in Australia. It asks who is providing criteria for assessing the non-domestically-trained foreign students that are entering

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Western education in increasing numbers? This global task has not yet been recognized and therefore is unassigned. This is an area of notable research opportunities as education continues to be one of the fastest growing international markets of this century. Another related area in need of immediate investigation is the creation of comprehensive ICT strategies with relevant learning outcomes and instruction designed to achieve them. Guidelines, such as the Academic ICT Baseline, upon which a P-12 institution might base integration policies, are rare. Few universities provide a transparent indication of the ICT students might use in personal self-evaluation of their skills and refer to in their preparations for International study.

8 WAYS FORWARD

This study is unique as it proves the existence of an Academic ICT Gap between the ICT skills required by Western higher education and the ICT skills of many commencing foreign students. To date, this is an unidentified assimilation issue for these students. The Academic ICT Gap may impact over 6 million students and their families. That is the number of commencing foreign students projected to enroll in International education in 2016 (ICEF Monitor, 2015).

8.1 Identifying learning challenges by differentiating skills

This research compared 28 ICT items between two related cohorts: Western university instructors and International teachers as proxy for their students. In *SurveyHE* university instructors ranked the importance of these 28 skills and in *SurveyP-12* the ICT skills of foreign students were estimated by their International teachers. Discrepancies between the respective data are important because they identify the specific learning areas that new university students may find a struggle.

For example, in a reexamination of the Dual-sample Independent *t*-Test *Mean* Comparison presented in Chapter 5, Table 28 presented a means comparison of the 29 ICT items for each survey and compared the means difference. Here we use the same differentiation data to identify learning challenges student do not expect but will need to overcome. The greatest *mean* differences (>±30%), weighted towards the university needs, were in literacy and numeracy ICT and in the delivery systems that support them. Table 31 indicates the *mean* comparison weighted to the *SurveyHE* data with values of 2-2.5=No and 2.5-3=Yes. All nine skills are within the No range. This indicates that while universities have ranked these skills as highly valuable International teachers do not believe that their students will have mastered these skills.

Table 31: Indicates the mean comparison weighted to *SurveyHE* data

Dual-Sample Independent *t*-Test Mean Comparison	*SurveyP-12* Mean	*SurveyHE* Mean	Means Difference
Hardware-PCs & laptop	2.08	2.96	**0.88**
Research & data-terminology: fields/records	2.34	2.94	**0.60**
Research & data-uses hyperlinks & navigation	2.38	2.93	**0.55**
Hardware-print/copy/scan	2.25	2.76	**0.51**
Hardware-USB & file storage	2.35	2.82	**0.47**
Spreadsheets-generate graphs/charts	2.20	2.62	**0.42**
Spreadsheets-formulae & basic calculations	2.19	2.6	**0.41**
Spreadsheets-terminology: column/row/cell	2.27	2.67	**0.40**
Research & data-record/catalogue/cite references	2.43	2.75	**0.33**

Of these 9 ICT items: 3 items affect the ability to conduct research, an important consideration at the university level; 3 ICT items affect composing spreadsheets, an important calculation and reporting tool basic to many of the STEM fields; and 3 are ubiquitous hardware that support the previous 6 items. The categories *Research* and *Spreadsheets* are the most important required ICT items ranked by university instructors. To develop these skills students need targeted instruction focused on authentic research, spreadsheet and maths projects. Without focused instruction students who lack these skills cannot be expected to perform at a rigorous academic level.

Conversely, this differentiation data also predicts the students' strengths which university instructors are not capitalizing on when creating curriculum. The greatest means difference (>±30%), weighted towards the students' abilities, were in social media-related ICT and the hand-held devices used to access it. Table 32 indicates the *mean* comparison weighted to the *SurveyP-12* data with values of 2-2.5=No and 2.5-3=Yes.

Table 32: Indicates the mean comparison weighted to *SurveyP-12* data

Dual-Sample Independent *t*-Test Mean Comparison	*SurveyP-12* Mean	*SurveyHE* Mean	Means Difference
Hardware-tablets	2.51	2.15	**-0.36**
Interactive applications-web design	2.43	1.98	**-0.45**
Interactive applications-3D animation	2.48	1.89	**-0.59**
Interactive applications-ESL & translation	2.49	1.92	**-0.57**
Interactive applications-mapping & GPS	2.55	1.95	**-0.60**

All five skills above are within the Yes range. While foreign students are strong in these skills, they are not valued for university work but possibly for a good reason. These ICT strengths are not *quid pro quo* with the strengths upon which rigorous research and STEM fields depend: the basic ICT skills marginalized in P-12 education.

It should be noted that *Hardware-PC and Laptop* (*SurveyHE*) as missing from the *SurveyP-12* priority list and are replaced with *Hardware-tablets* (*SurveyP-12*). Hand-held devices promote *fast-fingering* skills but do not directly translate to academic ICT skills. Emerging ICT and social media skills become the foreign students' communications platforms. University instructors should be cognizant of student expertise in non-academic/social ICT. These skills will not replace the need for basic ICT but can serve as a portal for transitional coursework that reinforces ICT standards.

The *SurveyHE* principal components analysis provides cause for reconsidering traditional definitions of ICT skillsets. The ICT item *loading* patterns were standard with the exception of 3 interesting indicators. In the principal component *Word processing* 3 ICT items cross-loaded to other principal components not normally associated with word processing. The components *Word processing-Creating text boxes/borders/columns* and *Multimedia-select/delete/crop/*copy cross-load with the components *Spreadsheet.* The components *Word processing-page orientation & document layout* cross-load with the *Research & data* component. These cross-loadings indicate that ICT items may naturally repurpose themselves to the extent they become embedded in new skills. Instructors should be aware of such natural repurposing and improve the range of ICT items used in any task in order to facilitate students' creative repurposing efforts. Table 33 provides the cross-loading of three ICT items during the factor analysis process.

Table 33: Example of *SurveyHE* cross-loading ICT items

ICT Item Sorted by Subgroup	Word Processing	Spreadsheet	Research & Data Offline	Research & Data Online	Interactive Application
Word processing-create text boxes/borders/columns	.390	.493			
Word processing-page orientation & document layout	.388		.354		
Multimedia-select/delete/crop/copy	.709	.312			

8.2 Identifying challenges by examining stakeholders

Achieving educational equity is an important challenge to the global community. Worldwide organizations, foundations and universities must seek to support innovation in education and help to decrease the digital technology gap (Laferriere et al., 2015, p. 2). This research study does not support the use of ICT/RPS in education as an either-or decision. Instead it reiterates the need for seamless integration of basic ICT performance skills upon which invested stakeholders: commerce, governments and rigorous researchers can expect students to build new competencies. Critical dimensions of context, including curriculum, classroom routines, teachers' roles and evaluation practices tend to be overlooked (Laferriere et al., 2015, p. 2). Appendix 4 provides the working draft from EDUsummIT 2015 which addresses criteria important to the relationship between 3rd party educational stakeholders.

8.2.1 Connecting P-12 schools with higher education

The optimal educational level for reversing the Academic ICT Gap is in the P-12 years. But without direct intervention from higher education, in the form of transparent information, P-12 schools cannot establish ICT learning standards universities require. Higher education must assess internal needs and provide guidance, an Academic ICT Baseline, upon which P-12 school can base decisions. Universities are not remedial institutions. They are not responsible for the ICT skills of commencing students. However, they do have a responsibility to make a good-faith-effort, to their present and future students, and develop and maintain a comprehensive listing of their educational ICT requirements. For higher education to depend on ICT for all areas of student interaction and to not publish such a skills listing is a travesty. This research strongly argues that a lack of connectivity between the preparatory schools and higher education is a dangerous oversight. Western higher education may not have unlimited time in which to make progressive changes. Competition is coming especially from the ‘Confucian’ countries, which see internationalization of higher education as a strategic mission and give substantial support to their higher education institutions (Pham, 2013, p. 3). It may be that, like developing countries, Western academics and supporting stakeholders only implement radical change when their profit centers are threatened.

8.2.2 Connecting higher education with commerce

Assuring employability has become one of the largest motivators for International students enrolled in Western higher education (Custer, 2015). Commercial influence in Western higher education is regularly debated. Before ICT the financial needs of higher education were manageable. However, the financial investment required to install and upkeep a modern ICT learning environment, at any educational level, are prohibitive. Commercial interests have many creative ways to influence education and students welcome their authentic collaboration. Educators should consider the use of explicit linkages between career and classroom learning as a way to improve satisfaction for Asian students, as well as using group projects and other approaches to developing collective knowledge. Students need to know more about what it actually takes to make the most of their investment. For their part, college educators need to know which educational practices and curricular pathways are most efficient in preparing students for success over the long term, and those pathways must be made much clearer to students and prospective students (Humphreys, 2013, p. 2). Ideally, business expects higher education to provide tools and curricular activities in which students collaborating with other students in other countries to complete projects, and learning through active projects that make a difference in their communities (Tappscott & Williams, 2006, p. 51). Researchers, on the other hand, must continue to assess whether Asian students have developed sufficient consumer consciousness to allow for adequate consideration of their motivations using a theory of consumer value (Lai et al., 2011, p. 284). These cultural challenges are formidable enough but students also face unnecessary academic challenges, such as the Academic ICT GAP.

8.2.3 Connecting higher education with national interests

ICT was introduced into education by Western governments who provided infrastructure support in exchange for the promise of dynamic researchers able to progress the national interests. Chapters 1-3 examined the best attempts of early academics and their respective governments to achieve seamless integration. This may have been possible had not digital technology developed at a rate faster than educators could integrate. The need to update and upgrade makes the cost of keeping ICT current prohibitive for all but the most visionary and well-endowed institutions. Governments and their agencies should be ready to introduce funding models and quality systems that will realize a vision of higher education as an engaged partnership between students and providers (Ramsden, 2008, p. 3). But does higher education need the most advanced ICT in order to provide an integrated learning experience? No; however, it does need a comprehensive plan on how to enrich education using basic, commercially-adaptable ICT and RPS. While reinforcing these skills in students, the emerging ICT can be monitored and incorporated into educational scenarios when cross-purposing warrants. Recent research from Europe and America indicates that for sustained progress and educational transformation to occur, educational objectives and strategies do not require cutting edge technologies. It is essential that there is the national will and wherewithal for supporting educational progress. Many educational professionals now support a return to fundamental goals with less emphasis on high-tech solutions (Natividad et al., 2015, p. 86).

8.2.4 Solutions for all stakeholders

In 2001, *digital inequality* was already a topic of study for some prescient researchers. "Because the rapidity of organizational as well as technical change means that we cannot presume that current patterns of inequality will persist into the future, we call on students of digital inequality to study institutional issues in order to understand patterns of inequality as evolving consequences of interactions among firms' strategic choices, consumers' responses and government policies (DiMaggio & Hargittai, 2001, pg. 3). More than ever before, higher education, government and commerce are symbiotic stakeholders in the business of education: each with different challenges they must solve in order to fulfil their stakeholder role. The commercial domain has erratic technological expectations; the political domain is wary of uncontrolled change; and the educational domain is expected to provide a speculative level of technological worker-training. Pressure is great on all three sectors to be autonomous yet they are interdependent. Higher education provides work-force and innovation training and must take leadership role in developing a global business model that addresses the transitional need for ICT skills across all sectors. Students support this expectation. Employability is the first priority of International students and their families when deciding on International higher education (Jones, 2013, p. 95). If higher education with the support of governments do not develop an adequate global workforce then business concerns will take control of training. Higher education has a window of opportunity in which to make changes but ICT mastery is pivotal to the process. English proficiency, effective communication skills and other 'soft skills' should be repositioned from the periphery to the center of all higher education curricula especially for STEM majors (Pham, 2013, p. 2). An unsettled business community is a powerful motivation for even the most indifferent governments to improve global policies. Movement towards involving 3rd parties in the funding of educational ICT is making progress in developing countries in Asia. Such groups influence decisions that secure ICT connectivity, build infrastructure, provide hardware and software and train users (Laferriere et al., 2015). Examples of such communal collaboration are growing in the Third-World but not enough of them are in place to make a bottom-up change in the Academic ICT Gap.

8.3 Future research

8.3.1 Academic questions – Present and future

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By providing proof of its existence, this thesis research only begins the investigation into the Academic ICT Gap. The extent to which the Academic ICT Gap impacts education, educators and other stakeholders, at every level, while apparent, has yet to be determined. Further research is needed to address questions and discussions such as:

- Are foreign preparatory students being denied major skillsets needed for academic success?
- Are universities prepared to become remedial institutions to make up for these insufficiencies?
- Is the Academic ICT Gap causing a *dumbing-down* of daily university work?
- Given the importance of these skills to STEM, could the Academic ICT Gap be directly responsible for less rigorous research being produced in such competitive fields?
- How does remediating an ICT skills discrepancy complicate the instructors' work load?
- By developing an Academic ICT Baseline, might universities achieve ICT transparency and aid in the development of effective ICT P-12 curriculum that meets the needs of higher education?
- What might the ancillary benefits of such an Academic ICT Baseline be to higher education: to instructors, to administrators and to academic planners and partners?
- During the *SurveyHE* PCA analysis some ICT items unexpectedly cross-loaded onto non-traditional components indicating a repurposing of these skillsets. With further research and a more comprehensive data gathering process I believe that these *outliers,* by cross-loading on more than one component or on a non-traditional component, could indicate the cross-purposing and/or inclusion of emerging ICT developments that are otherwise difficult to predict. This an area of research unique to this study and such indicators would be valuable information for educators wishing to place their teaching in the forefront of digital learning.

8.3.2 The Academic ICT Gap – Professional and personal rationale of further pursuit

While education reputedly embraces innovation, ICT have brought unprecedented change. The success of ICT learning has been driven from the bottom up: teachers and students adopting and adapting to digital change. It is to these teachers and students that decision makers must look for guidance.

This PhD research was the result of a need to turn empirical knowledge into tangible data that could be applied to educational contexts. To make the changes I believed would benefit my students I required credible data from a reputable source. *What are the ICT skills a student needs to be successful at university?* To answer this question I surveyed then examined ICT items (simplistic data) collected from 30% of Australian university systems (reputable source).

- As a journalist, working in traditional desktop publishing, I *learned* ICT as it was being invented.
- As a corporate director I knew the ICT requirements of global commerce.

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- As an International student I experienced the rigorous ICT demands of higher education.
- As an International teacher I observed the lack of authentic ICT instruction provided for preparatory students.
- As a parent I realized that public education was *caveat emptor* and that my child's success was influenced by others who may or may share my educational goals for my child.

To establish my academic credibility, I returned to university at the highest level to investigate an issue I believed would impact all levels of education. Appendix 16 displays my first professional step into presenting my theory to academics at the World Conference on Computers in Education, 2013. Because of their positive response, and many others since, I have brought this project to completion. My combination of experiences, my maturity and confidence resulted in a collection of uncomplicated data that proved my initial intuition correct and now allows me to upset curriculum on a grander scale. I would recommend this approach to anyone with tenacity, a driving question and an unquenchable urge to create change.

In 2012, I realized that I could not send another of my hard-working Chinese high school student off to college without telling them what they should expect of Western technology. I didn't want to alarm them; I wanted to change the system that was not honestly serving them and their parents. My goal seemed simple: I knew that academic decision-makers would not accept my conviction on the ICT changes that were needed no matter how experienced or credentialed I became. I would need to produce an Academic ICT Baseline that I would influence administrators and teachers in China and other developing countries to reconsider how ICT was taught. I found the perfect laboratory - Australian universities – and conducted my own experiment to create the first Academic ICT Baseline. Hopefully, the input from 400 Australian university instructors who select the ICT students use every day would have more impact than my lone voice on how we prepare our children for a digital education. Our children have such promise and we give them many opportunities. But, in exchange, we harness them with weighty expectations. Preparing them as best we can is the least we can do.

References

Abbasian, R., & Khajavi, Y. (2012). English Language Teaching Program of Universities: Does it cater for Multiple Intelligences of Students? *Porta Linguarum*, 21.

ablemetrics. (2015) 21st Century Skills assessment options. www.ablemetrics.com free, online educators resource In-development. [Webpage] Retrieved from http://www.assessmentfocus.com/ict-literacy.php

ACARA/NAPLAN. (2014). *National Assessment Program, proficiency levels - ICT Literacy*. Canberra, ACT.

Albion, P., Maroulis, J., & Jamieson-Proctor, R. (2010). *Patterns in student and staff access to, and attitudes towards usefulness of, ICT in an Australian university.* Paper presented at the Research Council of Engineering Education & Research in Higher Education Conference, Kuching, Malaysia.

Ameson International (2015). Ameson International Homepage. [Webpage] Retrieved from http://www.ameson.org/index.php

Ananiadou, K. and M. Claro (2009). 21st Century skills and competencies for new millennium learners in OECD countries. *OECD Working Papers.* OECD. 41: 34. Retrieved from http://dx.doi.org/10.1787/218525261154

Association of Governing Boards of Universities and Colleges. (2013). *Taking the board to school on educational technology.* AGBUC survey on technology and instruction. Open document. Washington, D.C.

Australian Bureau of Statistics. (2013). *International trade in goods and services.* An agenda for Australian higher education 2013-2016. Open Document. Canberra, ACT.

Bakia, M., Murphy, R., Anderson, K. & Trinidad, G. E., Murphy, R., Anderson, K., & Trinidad, G. E. (2011). *International experiences with technology in education: final report.* Retrieved from Washington, D.C.: www.ed.gov/about/offices/list/opepd/ppss/reports.html

Barnett, G., & Choi, Y. (1995). Physical distance and language as determinants of the international telecommunications network. *International Political Science Review*, 16(3), 249-265. http://dx.doi.org/10.1177/019251219501600305

Bell, T., Andrea, P., & Lambert, L. (2010). *Computer Science in New Zealand high schools.* Paper presented at the 12th Australasian computing Education Conference (ACE2010), Brisbane, Australia.

Bertot, J. C. (2003). The multiple dimensions of the digital divide: More than the technology 'haves' and 'have nots'. *Government Information Quarterly*, *20*(2), 185-191. http://dx.doi.org/10.1016/s0740-624x(03)00036-4

Bertram, A., & Waldrip, B. (2013). ICT for ICT's sake: Secondary teachers' views on technology as a tool for teaching and learning. *Australian Educational Computing*, *28*(1).

Bhatnagar, J. (2013). Use of ICT applications by student, faculty members & academic staff. *International Journal of Computing, Communications and Networking, 2*(4), 117-121.

Birtchnell, T. (2012). The elephant in the chat room: will international students stay home?. *The Conversation: Office of Learning & Teaching*: 1-3.

Bloom, B. S. (Ed.). (1972). *Taxonomy of Education Objectives Book 1-Cognitive Domain*. David McKay Company. Retrieved from http://www.ed.gov.nl.ca/edu/k12/evaluation/crts/cognitive_levels_learning.pdf

BOSTES Board of Studies Teaching & Educational Standards NSW. (2013). New South Wales School Connections. Sydney AU: *Board of Studies Teaching & Educational Standards NSW*. [Webpage] Retrieved from http://www.boardofstudies.nsw.edu.au/syllabus_sc/

Bodycott, P. (2009). Choosing a higher education study abroad destination: What mainland Chinese parents and students rate as important. *Journal of Research in International Education* 8(3): 349-374. http://dx.doi.org/10.1177/1475240909345818

Bodycott, P., & Lai, A. (2012). The influence and implications of Chinese culture in the decision to undertake cross-border higher education. *Journal of studies in International education*, *16*(3), 252-270. http://dx.doi.org/10.1177/1028315311418517

Boone, H., & Boone, D. (2012). Analyzing Likert Data. *Journal of Extension, 50*(2), 5.

Bork, A. (1979). Interactive Learning: Millikan Lecture, American Association of Physics Teachers, London, Ontario, June, 1978. *American Journal of Physics*, *47*(1), 5-10. http://dx.doi.org/10.1119/1.11684

Boyle, J. (2000). Education for Teachers of English in China. *Journal of Education for Teaching* 26(2): 147-156.

Bradsher, K. (2013). Next made-in-China boom: college graduates. *The New York Times*, *16*.

Brown, J. D. (2002). The Cronbach alpha reliability estimate. *Shiken: JALT Testing & Evaluation SIG Newsletter*, *6*(1), 17-19.

Brown, C., & Czerniewicz, L. (2010). Debunking the 'digital native': beyond digital apartheid, towards digital democracy. *Journal of Computer Assisted Learning, 26,* 357-369. http://dx.doi.org/10.1111/j.1365-2729.2010.00369.x

Brumley, M. (2013). No more digital immigrants. [Webpage] Retrieved from http://teachamazing.com/no-more-digital-immigrants/

Bruneforth, M., Gagnon, A., & Wallet, P. (2009). *Projecting the Global Demand for Teachers*. Retrieved from Quebec, CA: http://unesdoc.unesco.org/images/0018/001863/186397e.pdf

Butterfield, F. (1982). *China Alive in the Bitter Sea*. New York, NY: Times Books.

Carroll, L. (1917). *Through the looking glass: And what Alice found there*. Rand, McNally, Chapter 5.

Caruso, J. B. (2004). *ECAR study of students and information technology, 2004: Convenience, connection, and control.* Boulder, CO: EDUcause Center for Applied Research.

Caruso, J. and G. Salaway (2008). *ECAR study of undergraduate students and information technology, 2008.* Boulder, CO, EDUcause Center for Applied Research.

Chao, Lian-Ch'eng. (1948). English teaching in Chinese schools. *ELT Journal*, *2*(8), 201-213. http://dx.doi.org/10.1093/elt/ii.8.210

Chang, J., & Halliday, J. (2005). *The unknown story of Mao*. London, UK. Globalflair, Ltd. http://dx.doi.org/10.2307/20031825

Chauhan, A., Ying, Z., & Zhenfang, L. (2013). Role of ICT and learning English language in different perspective. *Interdisciplinary Journal of Contemporary Research in Business, 5*(7), 406-419.

Chen, L. (2013). Director, *Suzhou Middle School #10*. In J. Price (Ed.).

China News, (2013) Director-General Shen Jian of the JPDE Attends the Signing & Opening Ceremony of the Suzhou Dushu Lake Higher Education International Demonstration Zone. [Webpage] Retrieved from http://english.jsjyt.gov.cn/news/keynews/folder613/2013/01/2013-01-072603.html

Chinese Ministry of Education. (2003). *Report of educational statistics.* Beijing, PRC: Chinese Ministry of Education.

Clow, D. (2009, August 6). Digital residents and digital tourists. [Blog message]. Retrieved from http://dougclow.org/2009/08/06/digital-residents-and-digital-tourists

Cofino, K. (2009). It's not just a tool, technology as environment. [Report of panel discussion at Apple Hong Kong Summit, 2009]. Retrieved from http://www.techlearning.com/default.aspx?tabid=67&entryid=312

Coiro, J., Karchmer, R., & Walpole, S. (2006). Critically evaluating educational technologies for literacy learning: Current trends and new paradigms. *International handbook of literacy and technology* 2: 145-161.

Council of International Schools. (2015). Retrieved from https://www.cois.org/page.cfm?p=1884

Cox, P. (2002). *Improving Learning Processes: Principles, Strategies and Techniques*. Learning and Skills Development Agency, Regent Arcade House, 19-25 Argyll Street, London W1F 7LS, United Kingdom (Ref. No. 1345, free).

Crisp, G., Palmer, E., Turnbull, D., Nettelbeck, T., Ward, L., LeCouteur, A., Sarris, A., Strelan, P., & Schneider, L. (2009). First year student expectations: Results from a university-wide student survey. *Journal of University Teaching & Learning Practice. 6*(1), 3-21. DOI: 10.1007/s10734-008-9188-3.

Cuban, L. (2015) The lack of evidence-based practice: The case of classroom technology. Retrieved from https://larrycuban.wordpress.com/2015/02/05/the-lack-of-evidence-based-practice-the-case-of-classroom-technology-part-1/

Custer, S. (2015). Chinese consumers choose agents mostly based on reputation, says survey. *The PIE News*.

Cuttance, P., & Stokes, S. (2000). Monitoring progress towards the national goals for schooling: information and communication technology (ICT) skills and knowledge. Report to the *National Performance Monitoring Taskforce of the Ministerial Council on Education, Employment, Training and Youth Affairs*. Sydney, NSW.

Dabbagh, N., & Bannan-Ritland, B. (2005). *Online learning: Concepts, strategies, and application*. Prentice Hall.

Dahlstrom, E., Walker, J., & Dziuban, C. (2013). *ECAR study of undergraduate students and information technology, 2013*. Boulder, CO.

Damer, B. (2014). Digibarn Computer Museum. [Webpage] Retrieved from http://www.digibarn.com/collections/systems/xerox-8010

Davies-Rommetveit, S. (2014). Come Fly with Me. *Education Investor*. Retrieved from http://www.educationinvestor.co.uk/Default.aspx

Deacon, L. (2015). 2013 Canadian foreign student statistics. Ottowa, CA, *Canadian Bureau for International Education*: 2. Retrieved from www.cbie-bcei.ca

Dede, C. (2010a). Comparing frameworks for 21st century skills. *21st Century Skills: rethinking how students learn.* J. Bellanca. US, Solution Tree Press. 20: 51-76.

Dede, C. (2010b). Technological supports for acquiring 21st century skills. *International Encyclopedia of Education:* 9. http://dx.doi.org/10.1016/b978-0-08-044894-7.00739-9

DEEWR Department of Education, Employment and Workplace Relations. (2013). *Monthly summary of international student enrolment data - Australia - YTD October 2013*.

De Wit, K., Heerwegh, D., & Verhoeven, J. C. (2011). Changes in the basic ICT skills of freshmen between 2005 and 2009: Who's catching up and who's still behind?. *Education and Information Technologies*, *17*(2), 205-231. http://dx.doi.org/10.1007/s10639-011-9154-z

De Wit, K., Heerwegh, D., & Verhoeven, J. (2012). Do ICT competences support educational attainment at university?. *Journal of Information Technology Education: Research*, *11*(1), 1-25.

DeVellis, R. F. (2003). Scale Development (Vol. 26).

Dick, W., Carey, L., & Carey, J. (2005). The Systematic Design of Instruction. US: Pearson Learning Solutions.

DiMaggio, P., & Hargittai, E. (2001). From the 'digital divide' to 'digital inequality': Studying Internet use as penetration increases. *Princeton: Center for Arts and Cultural Policy Studies*, *Woodrow Wilson School, Princeton University*, *4*(1), 1-25.

Downes, T., Fluck, A., Gibbons, P., Leonard, R., Matthews, C., Oliver, R., Vickers, M., & Williams, M. (2001). *Making better connections : models of teacher professional development for the integration of information and communication technology into classroom practice*. Canberra, NSW: Australian Curriculum Studies Association.

Drucker, P. (1994). The theory of the business. *Harvard Business Review.* H. B. S. Publishing. Boston, MA, Harvard University.

Dwyer, T. (1976). The fundamental problem of computer-enhanced education and some ideas about a solution. *ACM SIGCUE Outlook*, *10*(3), 15-20. http://dx.doi.org/10.1145/963592.963593

Dwyer, D., Ringstaff, C. & Sandholtz, J. (1990). The evolution of teacher's instructional beliefs and practices in high-access-to technology classrooms. In Apple Classrooms of Tomorrow Research (Ed.), *Teachers Beliefs and Practices* (Vol. 1, p. 8). Cupertino, CA.

Economist (2014). English-language schools once aimed at expatriates now cater to domestic elites. *The Economist*. (International Print): 1-3. Retrieved from http://www.iscresearch.com/Portals/0/ISC%20Publicity%20-%20The%20Economist%20-%20International%20schools%20-%20The%20new%20local.pdf

Egbert, J., Paulus, T., & Nakamichi, Y. (2002). The Impact of CALL Instruction on Classroom Computer Use: A Foundation for Rethinking CALL Teacher Education?. *Language Learning and Technology, 6* (3), 108-126.

Ellis, A., & Newton, D. (2009). Understanding Australian first year university students' experiences of teaching and learning technologies. *International Journal on E-Learning, 11*(2), 23-35.

Elwood, J., & MacLean, G. (2009). ICT usage and student perceptions in Cambodia and Japan. *International Journal of Emerging Technologies and Society*, *7*(2), 65-82.

Engler, R. (2015). 2013 Foreign Student Statistics. Wellington, NZ, *New Zealand Tertiary Sector Performance Analysis.*

Ertmer, P., & Newby, T. (1996). The expert learner: Strategic, self-regulated and reflective. *Instructional Science, 26*, 25. DOI: 10.1007/BF001560.

Fabris, C. (2015). College Students Think They're Ready for the Work Force. Employers Aren't So Sure. *The Chronicle of Higher Education*.

Ferdinand, P. (2000). The Internet, democracy and democratization. *Democratization*, 7(1): 1-17 http://dx.doi.org/10.1080/13510340008403642

Fischer, K. (2014). For some foreign students, U.S. education is losing its attraction. *The New York Times,* (Asia Pacific), 7. http://www.nytimes.com/2014/05/26/world/asia/for-some-foreign-students-us-education-is-losing-its-attraction.html

Fliegler, C. (2013). Campus CFOs speak out on their expanding roles. *University Business*: 1-4.

Fluck, A. (2003). Integration or transformation? A cross-national study of information and communication technology in school education. *Faculty of Education*. University of Tasmania. Doctor of Philosophy: 331.

Friedman, T.L. (1999). *The Lexus and the Olive Tree: Understanding Globalization*. New York: Random House.

Gabor, D. (1963). *Inventing the future*. London, Secker & Warburg.

Georgieva, M. (2009, July 29). Be a digital citizen, not a digital tourist. [Blog message]. Retrieved from http://blog.hubspot.com/blog/tabid/6307/bid/4969/Be-a-Digital-Citizen-Not-a-Digital-Tourist.aspx

Global Education Futures Forum (2015). [Webpage] http://edu2035.org/

Global Times (2013). Time to cool down nationwide English mania. [Webpage] Shanghai Daily Online News. Retrieved from: http://www.globaltimes.cn/content/817030.shtml

Goh Chock Tong. (1997). *Shaping our future Thinking Schools, Learning Nation*. Singapore's Prime Minister's Opening Address at the 7th International Conference on Thinking, Suntec City Convention Centre Ballroom, Singapore. http://www.moe.gov.sg/media/speeches/1997/020697.htm

Goodman, A. (2012, March 22). Digital immigrants helping to build a digital nation. [Webpage] Retrieved from http://www.acquisio.com/uncategorized/digital-immigrants-helping-to-build-a-digital-nation

Grant, D., Malloy, A., & Murphy, M. (2009). A comparison of student perceptions of their computer skills to their actual abilities. *Journal of Information Technology Education*, *8*.

Griffin, P., McGaw, B., & Care, E. (2012). *Assessment and teaching of 21st century skills*. Dordrecht: Springer. http://dx.doi.org/10.1007/978-94-007-2324-5

Griffith, A. (2010). *SPSS for Dummies*. Indianapolis, IN: Wiley Publishing, Inc.

Grimshaw, T. (2011).The needs of international students rethought - implications for the policy and practice of higher education. *Teachers and Teaching: Theory and Practice* 17(6): 703-713. http://dx.doi.org/10.1080/13540602.2011.625147

Guoyuan, S., Valcke, M., van Braak, J., Tondeur, J., & Chang, Z. (2010). Predicting ICT integration into classroom teaching in Chinese primary schools: exploring the complex interplay of teacher-related variables. *Journal of Computer Assisted Learning, 27*(2), 160-172172. http://doi.org.10.1111/j.1365-2729.2010.00383.x

Gurney-Read, J. (2014). Fear of technology may hold back change in education, says Lord Puttnam. *The Telegraph.* Retrieved from http://www.telegraph.co.uk/education/educationnews/10617593.

Hallamon, T. (2001). *A study of the factors affecting the use of task analysis in the design of instruction.* Wayne State University, Detroit Michigan, US. Retrieved from http://ezproxy.utas.edu.au/login?url=http://search.proquest.com/docview/304726730?accountid=14245

Hargittai, E. (1999). Weaving the western web: explaining differences in Internet connectivity among OECD countries. *Telecommunications Policy*, 23, 701-718. http://dx.doi.org/10.1016/s0308-5961(99)00050-6

Hargittai, E. (2010). Digital na(t)ives? Variation in Internet skills and uses among members of the Net Generation. *Sociological Inquiry*, *80*(1), 92-113. http://dx.doi.org/10.1111/j.1475-682x.2009.00317.x

Haywood, J., Haywood, D., Macleod, H., Baggetun, R., Baldry, A. P., Harskamp, E., ... & Akademi, A. (2004). A comparison of ICT skills and students across Europe. *Journal of eLiteracy 1*(2): 69-81.

He, C., & Xiao, Y. (2004). *Business English learning in VLE: Students' perceptions. International Business English: Theory into Practice*. Beijing Business Publishing. Beijing, PRC.

Hewitt, D. (2008). *Getting rich first: Life in a changing China*. Random House.

Ho, Y. F. (1976). On the concept of Face. *American Journal of Sociology, 81*(4), 867-884.

Hornby, L. (2013). International school in China point students to the west. . *New York Times*. New York, NY, New York Times. Global Business: 1-3.

Hoskin, T. (2014). Parametric and nonparametric: Demystifying the terms. In *Mayo Clinic*. Retrieved from: http://www.mayo.edu/mayo-edu-docs/center-for-translational-science-activities-documents/berd-5-6.pdf

Houcine, S. (2011). The effects of ICT on learning/teaching in a foreign language. *Retrieved September*, *1*, 2012.

Howard, S. (2009). *Teacher Change* (PhD), University of Sydney, Sydney, AU.

Hu, L., & Webb, M. (2009). Integrating ICT to higher education in China: From the perspective of activity theory. *Educational Information Technology*, 14, 143-161. http://dx.doi.org/10.1007/s10639-008-9084-6

Hu, S., & Seifman, E. (1987). *Education and socialist modernization: A documentary history of education in the People's Republic of China, 1977-1986* (Vol. 3). Ams Pr Inc.

Huang, F. (2005). Globalization and changes in Chinese higher education. *Globalization and Higher Education*. R. I. P. S. 9. Japan, RIHE International Publication: 41-50. http://dx.doi.org/10.1177/027046768800800415

Humphreys, D. (2013). Success after college: What students, parents and educators need to know and do. *Association of American Colleges and Universities, 99*(2), 1-5. Retrieved from https://aacu.org/liberaleducation/le-sp13/humphreys.cfm

Institute of International Education (2015). International Students: Leading Places of Origin. *Open Doors*. Washington DC, Institute of International Education: 2.

instructionaldesigncentral. (2012). Instructional Design Timeline. Retrieved from http://www.instructionaldesigncentral.com/htm/IDC_instructionaltechnologytimeline.htm

International College of Economics and Finance (ICEF) Monitor, (2014). *New data on international schools suggest continued strong growth* March 18, 2014. Retrieved from http://monitor.icef.com/2014/03/new-data-on-international-schools-suggests-continued-strong-growth-2/.

International Society for Technology in Education, (2013). Standards for students. Retrieved from https://www.iste.org/standards/standards-for-students

International TEFL Academy (2015). World Comparison Chart for Teaching English Abroad. [Webpage] Retrieved from http://www.internationalreflacademy.com/country-chart-world-index-enlgish-teaching-jobs

Ivanov, P. (2013). Chinas higher education revolution. *Lowy Institute for International Policy's New Voices Conference 2011: Dynamic Asia*: 5.

Jaschik, S. & Lederman, D. (2013). *The 2013 inside higher ed survey of college and university business officers.* Gallup Poll conducted by Inside Higher Ed for Academic Partnerships. Washington, D.C. Retrieved from http://www.insidehighered.com

Jiang, J. (2013). Critical thinking in general education in China. *International Journal of Chinese Education 2*(1): 108-134. http://dx.doi.org/10.1163/22125868-12340016

Johnson, J., Ludolph, F., Smith, D. & Irby, C. (1985). *The desktop metaphor as an approach to user interface design*. X. O. Systems. Palo Alto, CA, Xerox Office Systems: 1-2. http://dx.doi.org/10.1145/320435.320594

Jones, C., Ramanau, R., Cross, S., & Healing, G. (2010). Net generation or Digital Natives: Is there a distinct new generation entering university?. *Computers & Education*, *54*(3), 722-732. http://dx.doi.org/10.1016/j.compedu.2009.09.022

Jones, E. (2013). Internationalization and employability: the role of intercultural experiences in the development of transferable skills. *Public Money & Management 33*(2): 95-104. http://dx.doi.org/10.1080/09540962.2013.763416

Jones, E., & de Wit, H. (2012). Globalization of internationalization: Thematic and regional reflections on a traditional concept. *AUDEM: The International Journal of Higher Education and Democracy*, *3*(1), 35-54.

Jonassen, D., Tessmer, M., & Hannum, W. (1999). What is Task Analysis? *Task analysis methods for instructional design*. USA & London: Lawrence Erlbaum Associated.

Jung, S. H. (2006). The use of ICT in learning English as an international language. *Department of Curriculum and Instruction*. College Park, MD, University of Maryland.

Jung, S. H. (2009). A reality check on students' preparedness for 21st century CALL activities. *Multimedia - Assisted language learning 12*(1): 35-57.

Kearney, M.L. & Yelland, R. (2010). Higher education in a world changed utterly: Doing more with less. Discussion paper of the *International Management in Higher Education Conference*. Paris, FR: OECD.

Kearney, S. (2012). Improving engagement: the use of 'Authentic self-and peer-assessment for learning'. *Assessment & Evaluation in Higher Education, 38*(7), 875-891. DOI: http://dx.doi.org/10.1080/02602938.2012.751963

Keeling, A. (2015). Setting Up an International School. *Independent School Govenor's Handbook*. I. S. C. Group. London, UK: 81-85.

Keengwe, J. (2007). Faculty integration of technology into instruction and students' perceptions of computer technology to improve student learning. *Journal of Information Technology Education*, *6*.

Kemph, K. (1961). *Electronic computers within the ordinance corps*. United States Department of Defense. Aberdeen Proving Ground, Maryland US, US DOD.

Kennedy, G., Judd, T., Churchward, A., Gray, K., & Krause, K. (2008). First year students' experiences with technology: Are they really digital natives? *Australasian Journal of Educational Technology*. 24(1) 108-122.

Kennedy, G., Dalgarno, B., Bennett, S., Judd, T., Gray, K., & Chang, R. (2008). *Immigrants and natives: Investigating differences between staff and students' use of technology*. Paper presented at the ascilite 2008 Conference, Melbourne, VIC.

Kevat, P. (2013). International student visa and enrolment trends for the MESDC. *ICEF Australia New Zealand*. Brisbane, AU, Gomda Consulting: 32.

Kir, E., & Kayak, S. (2012). The analysis of ICT skill levels of foreign language instructors working at universities. *The Online Journal of New Horizons in education. 2*(4): 34-41.

Kline, R. B. (2005). *Principles and practice of structural equation modeling* (2nd ed). New York: Guildford.

Kperogi, F. (2013). Writing and grammar in the age of social media. [Web page] CodeWit World News.

Ku, H. Y., Pan, C. C., Tsai, M. H., & Tao, Y. C., R. (2004). The Impact of Instructional Technology Interventions on Asian Pedagogy. *Educational Technology Research and Development, 52*(1), 5. DOI: 10.1007/BF02504776

Laferriere, T., Shonfeld, M., Resta, P., Passey, D., Bhowmik, M., Yazbak, M., Price, J. Gross, D. (2015). *Addressing Gaps and Promoting Educational Equity*. Paper presented at the EDUsummIT 2015, Bangkok, TH.

Lai, L., To, W. M., Lung, J., & Lai, T. M. (2011). The perceived value of higher education: the voice of Chinese students. *Higher Education, 63*(3), 271-287. DOI: 10.1007/s10734-011-9439-6

Lederman, D. (2013). CFO survey reveals doubts about financial sustainability *Inside Higher Education* (July 12, 2013), 1-6. Retrieved from http://www.insidehighered.com/news/survey/cfo-survey-reveals-doubts-about-financial-sustainability

Levin, D. (2012). A Chinese education, for a price. *The New York Times*, A8.

Lee, J. W. (2003). Economic growth and human development in the Republic of Korea, 1945-1992. *Reconstruction*, *1945*, 61.

Li, L., & Walsh, S. (2010). Technology uptake in Chinese EFL classes. *Learning Teaching Research, 15*(1), 99-125. DOI: 10.1177/1362168810383347

Li, Y., & Ranieri, M. (2010). Are 'digital natives' really digitally competent? - A study on Chinese teenagers. *British Journal of Educational Technology*, *41*(6), 1029-1042. http://dx.doi.org/10.1111/j.1467-8535.2009.01053.x

Liddell, H. G. , & Scott, R. (1980). *A Greek-English Lexicon (Abridged Edition)*. United Kingdom: Oxford University Press. ISBN 0-19-910207-4.

Lillard, L., & Willis, W. (1994). Intergenerational Educational Mobility: Effects of Family and State in Malaysia. *The Journal of Human Resources, 29*(4), 1126-1166.

Lim, L. (2010). China's 'little emperors' lucky, yet lonely in life. *National Public Radio (USA)*.

LinkedIn *SurveyP-12* Commentary, (2015). https://www.linkedin.com/grp/post/122431-5819195938912088067

Lloyd, M. (2005). *Towards a definition of the integration of ICT in the classroom*. AARE '05 Education Research - Creative Dissent: Constructive Solutions, Parramatta, NSW, Australian Association for Research in Education.

Löfström, E. and A. Nevgi (2007). From strategic planning to meaningful learning: diverse perspectives on the development of web-based teaching and learning in higher education. *British Journal of Educational Technology 38*(2): 312-324. http://dx.doi.org/10.1111/j.1467-8535.2006.00625.x

Lohr, L. (2004). Curriculum, plans, and processes in instructional design: International perspectives *Educational Technology Research and Development, 53*(3), 2. DOI: 10.1007/BF02504802

Lu, J., & Short, M. (2012). *Learning and living: the challenges facing Chinese students in the Australian context.* Paper presented at the auamii Conference 2012, Phuket, TI.

Lu, S., & Whiteman, H. (2015). China's university entrance exams Would you pass? *CNN Online*, 5.

Luehrmann, Arthur. (1979). Technology in science education. *Technology in Science Education: The Next Ten Years-Perspectives and Recommendations.* Science Education Directorate. National Science Foundation. Washington, D.C.

MacLean, G., & Elwood, J. (2009). Digital natives, learner perceptions and the use of ICT. *Handbook of Research on Web 2.0. 2*: 156-178. http://dx.doi.org/10.4018/978-1-60566-190-2.ch009

Mahbubani, K. (2008). *The New Asian Hemisphere*. New York, NY, Public Affairs. http://dx.doi.org/10.1007/s10308-008-0172-4

Margaryan, A., Littlejohn, A., & Vojt, G. (2011). Are digital natives a myth or reality? University students' use of digital technologies. *Computers & Education*, *56*(2), 429-440. http://dx.doi.org/10.1016/j.compedu.2010.09.004

Mathou, C., & Yan, J. (2012). EU-China Student and Academic Staff Mobility: Present Situation and Future Developments. *International Journal of Chinese Education*, *1*(2), 282-300. http://dx.doi.org/10.1163/22125868-12340008

Mavrides, G., & Hayes, K. (2012). China's education system, Chinese students and the foreign English teacher. *Foreign Teachers guide to Living and Working in China*, 11. http://middlekingdomlife.com/guide/chinese-education-system-students-english-teacher.htm

Maxwell, D. (2015). High demand drives massive growth of international education in Asia. *Asian Correspondent*. Retrieved from http://asiancorrespondent.com/130101/demand-drives-massive-growth-of-international-education-in-asia/

McComas, W. (2014). *The Language of Science Education*. Rotterdam, The Netherlands, Sense Publishers. http://dx.doi.org/10.1007/978-94-6209-497-0_2

McGowan, S., & Potter, L. (2008). The implications of the Chinese learner for the internationalization of the curriculum: An Australian perspective. *Critical Perspectives on Accounting*, *19*(2), 181-198. http://dx.doi.org/10.1016/j.cpa.2005.12.006

Min, J. (2013). *Chinese middle school experiences*. In J. Price (Ed.), (p. 4).

Mokhtar, I., & Majid, S. (2008). Information literacy standards, guidelines and their implementation: an analysis. *DESIDOC Journal of Library & Information Technology*, *28*(2). http://dx.doi.org/10.14429/djlit.28.2.160

Molnar, A. (1973, April). *The Computer and the Fourth Revolution.* Paper presented at the Association for Educational Data Systems Annual Convention, New Orleans, LA.

Moodly, A., & Adu, E. O. (2014). ICT in Education for Sustainable Development (ESD) Quality Teaching and Learning Outcomes. 197-202.

Moore, G. (1965). Cramming more components onto integrated circuits. *Electronics Magazine, 38*(8), 114-117. http://dx.doi.org/10.1109/jproc.1998.658762

Moran, M., Seaman, J., & Tinti-Kane, H. (2011). *Teaching, learning, and sharing: How today's higher education faculty use social media*. Boston, MA: Pearson Learning Solutions.

Murphy, R. (2001). *A briefing on key skills in higher education*. Retrieved from www.ltsn.ac.uk/genericcentre

Nagrath, C. (2011) International Schools - Understanding the Differences. *The International Educator* Online, 4, Retrieved from https://www.tieonline.com/view_article.cfm?ArticleID=89

National Agency for Higher Education. (1997). National policies for the internationalization of higher education in Europe. Stockholm, SW: *Organization for International Cooperation in Higher Education.*

National Research Council. *Being fluent with information technology*. Washington, DC: The National Academies Press, 1999.

Natividad, G., Mayes, R., Choi, J. I., & Spector, J. M. (2015). Balancing stable educational goals with changing educational technologies. *e-mentor, 1*(58), 83-94.

Oblinger, D. G., & Verville, A. L. (1998). *What Business Wants from Higher Education. American Council on Education/Oryx Press Series on Higher Education*. Oryx Press, PO Box 33889, Phoenix, AZ 86067-3889.

Olina, Z., & Sullivan, H. (2002). Effects of Classroom Evaluation Strategies on Student Achievement and Attitudes. *Educational Technology Research and Development, 50*(3), 14. DOI: 10.1007/BF02505025

Oliver, R., & Towers, S. (2000, December). Benchmarking ICT literacy in tertiary learning settings. *Learning to choose: Choosing to learn. Proceedings of the 17th Annual ASCILITE Conference* (p. 381-390).

Olsen, K. (2015). 10 Most Memorable Tech CEOs of the Digital Era. from http://www.pcmag.com/slideshow_viewer/0,3253,l=259624&a=259624&po=3,00.asp.

Osse, C. (2011). The China World Wide Web vs. World Wide Web: Working around the Great Firewall. *ZaiShanghai*. Shanghai, PRC, WordPress.

Partnership for 21st Century Skills P21stCentSkills (2006). 21st Century Skills Assessment e-paper, 14.

Palmer, P. (1991). The Courage to Teach. *The National Teaching and Learning Forum, 1*(2), 12.

Papert, S. (1978). Personal computing and its impact on education. In *Proceedings of the P. Wegg Memorial Conference. Iowa City: University of Iowa*.

Parkes, M., & Reading, C. (2013). The competencies required for effective performance in a university e-learning environment. *Australasian Journal of Educational Technology 29*(6): 777-791.

Parry, S. (1998). Just what is a competency (and why should you care?). *Training, 35*(6), 58-64.

Peeraer, J., & Van Petegem, P. (2011). ICT in teacher education in an emerging developing country: Vietnam's baseline situation at the start of 'The Year of ICT'. *Computers & Education*, *56*(4), 974-982. http://dx.doi.org/10.1016/j.compedu.2010.11.015

Pelliccione, L. (2001). *Implementing innovative technology: Towards the transformation of a university*. Curtin University of Technology.

People's Daily Online. (2008). *Move to reduce student myopia.* Sept. 23, 2008. http://english.peopledaily.com.cn/90001/6504067.html

Pepper, S. (2000). *Radicalism and education reform in 20th century China: The search for an ideal development model*. USA: Cambridge University Press. http://dx.doi.org/10.1017/cbo9780511584725

Pham, H. (2013). The threat of falling behind in international students. *University World News, 22-Sep-13 07:59:45*(288), 3. http://www.universityworldnews.com/article.php?story=20130917160717159

PIE Professionals in International Education. 2015. http://thepienews.com/news/international-schools-expected-reach-3-7m-students-2014/

Porfilio, B., & Yu, T. (2006). Student as consumer: A critical Narrative of the commercialization of teacher education. *Journal for Critical Education, 4*(1), 225-243. Retrieved from http://www.jceps.com/wp-content/uploads/PDFs/04-01-9.pdf

Powell, V., & Lehe, L. (2015). Principal component Analysis explained visually. from http://setosa.io/ev/principal-component-analysis/

Prensky, M. (2001). Digital natives, digital immigrants part 1. On the horizon, 9(5), 1-6. http://dx.doi.org/10.1108/10748120110424843

Price, J. (2006). *Instructional Design: MYP ICT Scaffold*. Suzhou, China.

Price, J. (2005). *An Exercise in Instructional Design: Ideas for the Future.* (Master of Science), The University of Edinburgh, Edinburgh, UK.

Rabkin, A. (2011). The Social(ist) Networks. *fastcompany.com*. US, Fast Company Business: 68-75.

Ramsden, P. (2008). *The future of higher education teaching and student experience* Retrieved from UK:

Ratiu, I. G., & David, N. (2007). European computer driving license (ECDL) and international computer driving license (ICDL). *Management and Socio-Humanities:* 83-89.

Rider, F. (1944). The future of library science. *The Scholar and the Future of the Research Library*: 8. http://dx.doi.org/10.2307/361817

Robyler, M., Castine, W., & King, F. J. (1988). *Assessing the Impact of Computer-Based Instruction: A review of recent research* (Vol. 3/4). New York: Hayworth Press.

Ross, H. (2005). China country study. Submitted for Global Monitoring Report for the United Nations Educational, Scientific and Cultural Organization (UNESCO). Retrieved from http://unesdoc.unesco.org/images/0013/001373/137333e.pdf

Rushby, N. J. (1979). An introduction to educational computing. London, UK: Croom Helm Ltd. http://dx.doi.org/10.1016/0360-1315(79)90024-1

Sang, G., Valke, M., van Braak, J., Tonduer, J., & Zhu, C. (2010). Predicting ICT integration into classroom teaching in Chinese primary schools: exploring the complex interplay of teacher-related variables.

Journal of Computer Assisted Learning, 27(2), 160-172. http://dx.doi.org/10.1111/j.1365-2729.2010.00383.x

Schwartzman, R. (1995). Students as customers: A mangled managerial metaphor. *Carolinas Speech Communication Association Convention*. Charlotte, NC: 32.

Search Associates, (2015). http://www.searchassociates.com/About-Us/About-Search-Associates.aspx

Seeberg, V. (1990). *Literacy in China: the effect of the national development context and policy on literacy levels, 1949-79.* Bochum: Brockmeyer. http://dx.doi.org/10.2307/2057237

Selwyn, N. (2010). Degrees of digital division: reconsidering digital inequalities and contemporary higher education. *RUSC. Revista de Universidad y Sociedad del Conocimiento, 7*(1). Retrieved from http://hdl.handle.net/10609/2963

Smith, A., & Humphreys, M. (2006). Evaluation of unsupervised semantic mapping of natural language with Leximancer concept mapping. *Behavior research Methods, 38*(2), 18.

Smith, B. (2016). Australia: international education exports hit record $19.65bn. *The PIE News* 8 Retrieved from: http://thepienews.com/news/australia-international-education-exports-hit-record-19-65bn/

Smith, B. (2014) UK: Exam fraud fallout hits 57 private colleges and 3 universities. *The PIE News* 8 Retrieved from http://thepienews.com/news/57-colleges-suspended-45000/

Smith, J. (2013). Desktop Applications vs. Web Applications. *Street Directory*. from http://www.streetdirectory.com/travel_guide/114448/programming/desktop_applications_vs_web_applications.html.

Snow, R. (1983). *Creating Media Culture* (Vol. 149). Berkley Hills, CA: Sage Library of social Research.

Spring, J. (2012). Globalization of education. *International Journal of Chinese Education, 1*(2), 139-176. doi:10.1163/22125868-12340002

SPSS IBM Statistical Program for Social Sciences© (2015). Statistical support retrieved from http://www.academia.dk/BiologiskAntropologi/Epidemiologi/PDF/SPSS_Survival_Manual_Ver12

Statistics Help for Students Guides (2008). [Webpage] Retrieved from http://statistics-help-for-students.com

Stemler, S. (2001). An overview of content analysis. *Practical assessment, research & evaluation, 7*(17), 11. Retrieved from PAREonline.net website: http://PAREonline.net/getvn.asp?v=7&n=17

Suppes, P. (1975). Impact of computers on curriculum in the schools and universities. *In: Computer and education. Amsterdam: North-Holland*.

Suppes, P. (1977). The future of computers in education. *Committee on Science and Technology*. Washington D.C., U.S. Government Printing Office**,** 548-569.

Suhr, D. (2006). Exploratory or Confirmatory Factor Analysis? USA, University of Northern Colorado: 17.

Sysoyev, P., & Evstigneev, M. (2014). *Foreign language teachers' competency and competence in using information and communication technologies.* Paper presented at the XXV Annual International Academic Conference, Language and Culture, Tomsk State University, Tomsk, RU.

Taylor, R. P. (Ed.). (1980). The computer in school: Tutor, tool, tutee. New York, NY: Teachers College Press.

TeachAway (2015). International Schools. from http://www.teachaway.com/international-schools

Tessmer, M., & Richey, R. (1997). The Role of Context in Learning and Instructional Design *Educational Technology Research and Development, 45*(2), 40. doi: 10.1007/BF02299526

Texas Essential Knowledge and Skills (TEKS) *Grade 5* (Vol. 110.6-123.3). 2005. Revised: 2011 & 2013. Texas Administrative Code, State Board of Education. Texas Education Agency. Austin, TX. Retrieved from http://ritter.tea.state.tx.us/rules/tac/chapter126/index.html

Thang, S., Jaafar, N., Nambiar, R., Amir, Z., & Wong, F. (2014). Are Malaysian undergraduates digital natives in the true sense of the word? *The Southeast Asian Journal of English Language Studies, 20*(1), 177-191. http://dx.doi.org/10.17576/3l-2014-2001-14

the JOURNAL, (2013). Timeline: 50 years of computing [Webpage] Retrieved from http://thejournal.com/Articles/1997/06/01/Timeline-50-Years-of-Computing.aspx?Page=2&p=1.

Thoman, E., & Jolls, T. (2005). 10. Media Literacy Education: Lessons from the Center for Media Literacy. *Yearbook of the National Society for the Study of Education*, *104*(1), 180-205.

Trencheva, T., & Denchev, S. (2013, June). Intellectual Property Education in University Environment in Bulgaria. In *International Conference on the Future of Education* (Vol. 3, p. 743-746).

Tripp, D. (1992). Critical theory and educational research. *Issues in Educational Research, 2*(1), 9.

Trotter, Andrew. 2008. Market for K-12 Course-Management Systems Expands. *Education Week*. 27:25, p. 10. http://www.edweek.org/ew/articles/2008/02/27/25biz.h27.html?r=749125259.

Turner, R. (1972). *Myths of the Vietnam War: The Pentagon Papers Revisited*. USA, American Friends of Vietnam.

UK Council for International Student Affairs (2015). 2013 International student statistics: UK higher education. London, *UK Council for International Student Affairs*.

University of Tasmania. (2012). *Open to talent: strategies 2012 – onwards*. Hobart, TAS. http://www.utas.edu.au/__data/assets/pdf_file/0005/263876/open-to-talent-strategies.pdf

US Congress Office of Technology Assessment. (1988). *Power On! New tools for teaching and learning*. Washing D.C. US Government Printing Office.

Usluel, Y. K., Askar, P., & Baş, T. (2008). A structural equation model for ICT usage in higher education. *Journal of Educational Technology & Society*, *11*(2).

van Braak, J. & Goeman, K. (2003). Differences between general computer attitudes and perceived computer attributes: Development and validation of a scale. *Psychology Reports. 92*(2), 655-660. http://dx.doi.org/10.2466/pr0.92.2.655-660

Venables, A., Miliszewska, I., & Tan, G. (2012). *Information technology and society: an exchange of Australian and Chinese perspectives*. 9th International Conference on Cooperative Education and Work Integrated Learning (WACE), Portland, OR.

Verhoeven, J. C., Heerwegh, D., & De Wit, K. (2010). Information and communication technologies in the life of university freshmen: An analysis of change. *Computers & Education, 55*(1), 53-66. http://dx.doi.org/10.1016/j.compedu.2009.12.002

Voogt, J., & Knezek, G. (Ed) (2008). *International handbook of information technology in primary and secondary education* (Vol. 20). Springer. http://dx.doi.org/10.1007/978-0-387-73315-9

VoteView (2015). Entrepreneurs and American Economic Growth - William Gates. from http://www.voteview.com/gates.htm.

Wallace, P., & Clariana, R. B. (2005). Perception versus reality-determining business students' computer literacy skills and need for instruction in information concepts and technology. *Journal of Information Technology Education*, *4*.

Wang, Y. (2008). Student attacks against teachers: The revolution of 1966. The Chinese Holocaust Museum (online), University of Chicago. [Webpage] Retrieved from http://humanities.uchicago.edu/faculty/ywang/history/1966teacher.htm.

Waters, J., & Brooks, R. (2011). International/transnational spaces of education. *Globalisation, Societies and Education 9*(2): 155-160. http://dx.doi.org/10.1080/14767724.2011.576933

Way, J., & Webb, C. (2007). A framework for analysing ICT adoption in Australian primary schools. *Australasian Journal of Educational Technology 23*(4): 559-582.

Waycott, J., Bennett, S., Kennedy, G., Dalgarno, B., & Gray, K. (2010). Digital divides? Student and staff perceptions of information and communication technologies. *Computers & education*, *54*(4), 1202-1211. http://dx.doi.org/10.1016/j.compedu.2009.11.006

Weinstein, B. (1983). The civic tongue: Political consequences of language choices. New York, NY: Longman.

Woodside, A. (1992) Real and imagined continuities in the Chinese struggle for literacy. In R. Hayhoe (Ed.), Education and Modernization: The Chinese Experience (p. 23–45). New York, NY: Pergamon Press.

Wolf, M. (2007). *Proust and the Squid: The story and science of the reading brain*. Cambridge, MA, Harper Collins.

World Bank. (2015). China Overview Data. [Webpage] Retrieved from http://www.worldbank.org/en/country/china/overview

Xi, S. (2013). The price of education in China. *All China Women's Federation*, 3. http://www.womenofchina.cn/html/womenofchina/report/152437-1.htm

Xueqin, J. (2011). Thinking right: coaching a wave of Chinese students for college in America. *The Chronicle*, 3. Retrieved from http://chronicle.com/article/Thinking-Right-Coaching-a/128287/

Yan, K. & Berliner, D. (2009). Chinese international students' academic stressors in the United States. *College Student Journal, 43*, 939-960. http://dx.doi.org/10.1353/csd.2013.0010

Yan, S. (2012, September 14, 2012). Men Outclassed. *Global Times News,* p. 1.

Zhang, J. (2007) A cultural look at information and communication technologies in Eastern education. *Educational Technology Research and Development, 55*, 301-314. http://dx.doi.org/10.1007/s11423-007-9040-y

Zhao, L., Lu, Y., Huang, W., & Wang, Q. (2010). Internet inequality: The relationship between high school students' Internet use in different locations and their Internet self-efficacy. Computers & Education, 55, 1405-1423. http://dx.doi.org/10.1016/j.compedu.2010.05.010

Zhao, L., Lu, Y., Wang, B., & Huang, W. (2011). What makes them happy and curious online? An empirical study on high school students' Internet use from a self-determination theory perspective. *Computers & Education, 56*(2), 346-356. http://dx.doi.org/10.1016/j.compedu.2010.08.006

Zhenyang, C. (2009). The Singapore-Malaysian Water Wars. Suzhou, China, International Baccalaureate: 17.

Zhu, C. (2010). Teacher roles and adoption of educational technology in the Chinese context. *Journal for Educational Research Online, 2*(2), 72-86.

Zimmerman, B. J. (2002). Becoming a self-regulator learner: An overview. *Theory into Practice, 41*(2), 8.

Zur, O., & Zur, A. (2011). On digital immigrants and digital natives: how the digital divide affects families, educational institutions, and the workplace. *Zur Institute-Online Periodical*, 10. [Webpage] Retrieved from http://www.zurinstitute.com/digital_divide.html

Appendices

Appendix 1: Australian Council for Computers in Education (ACCE) Adelaide, 2014

WHAT DO AUSTRALIAN UNIVERSITIES WANT IN STUDENT ICT SKILLS?

Abstract

This paper reports on a study that sought to identify the information and communications technology (ICT) used daily in Australia higher education institutions (HEI). Four hundred and one educators from fourteen Australian universities ranked the importance of sixty-two ubiquitous and emerging hardware, software and online applications to determine what student ICT skills were necessary to successfully complete their particular curricula. These sixty-two skills were apportioned according to their common usage and divided into ten categories: communications & email; content management systems (CMS); database management; graphics; hardware; interactivities; multimedia presentations; research; spreadsheets; and, word processing. This paper presents quantitative data collected on the use of these ten categories across the faculties of Arts, Business & Commerce, Education, Health Science, Library & Research, Social Science and Science, Technology, Engineering and Mathematics (STEM). The study revealed that students need advanced ICT skills in seven of the ten categories to successfully engage in university studies.

Keywords: ICT skills, International Students, Foreign Students, Australian Higher Education

REVIEW OF THE LITERATURE AND THEORETICAL FRAMEWORK

As a member of an academic knowledge-based society, a student's ICT skills are equally as important as their language skills. Of what value are science, maths, research or critical thinking skills if the student cannot express their knowledge in an acceptable academic format, using the communication tools ubiquitous to higher education? When considering the foreign student, schooled off-shore, what assurance do educators have that she possesses the necessary ICT skills to undertake a rigorous tertiary program? Without an ICT assessment tool applied pre-enrolment, the lecturer becomes responsible for identification and remediation of any ICT skills inadequacies. This study polls university ICT to help inform educators' assessment and remediation decisions. The literature reviewed below supports the need for such a study and recommends the results be seriously considered to the advantage of all university stakeholders.

The global economic crisis of 2007 has caused higher education institutions to rethink traditional business models into forms that can more rapidly respond to changes in global dynamics. The Organization for Economic Co-operation and Development (OECD), suggested these new model must also depend on the calculated use of ICT. In September 2012, the OECD presented a discussion paper at the Institutional Management in Higher Education General Conference entitled Higher Education in a World Changed

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Utterly – Doing More with Less (Kearney & Yelland, 2012). The OECD put forth eight topical areas, in twenty-four questions, to guide members when drafting a new scenario for the advancement of tertiary education. Of these eight topics, three directly impact this research study as they are grounded in the ubiquitous use of ICT: *funding, governance and measuring/improving quality, relevance and effectiveness.*

Funding changes require that administrative policies are developed that resolve the mismatch between who pays and who benefits from tertiary education. This mismatch was a focal subject of The 2013 Inside Higher Ed Survey of College and University Business Officers. Edited by Jaschik & Lederman, this survey reported that 457 American College and University Business Officers (CUBO) expressed a lack of definitive information when costing-out, adding or enhancing technology-related services or delivery systems. The data is not there. Instead these CFOs fall back on traditional pragmatic factors such as cutting costs, boosting enrolments, streaming delivery systems, increasing tuition fees, increasing teaching loads and curbing staff development expenditures. While 65% supported academic collaboration with other institutions they admitted that without valid data to guide the process, implementing these priorities might be short-sighted. In the same year, over two-thousand American members of the Association of Governing Boards of Universities and Colleges (AGBUC) were surveyed. Only 19% said that their boards are prepared to decide which ICT to invest in with an additional 20% admitting that their boards exhibited "poor execution of this area of oversight". Between one-half and two-thirds of respondents said they received "fair", "poor" or no information and indicated they are not even aware of the ICT initiatives taking place on their own campuses. While 57% think massive online open courses (MOOCs) will have a positive academic impact, 56% say MOOCs will have an adverse economic effect at a time when they are defending tuition increases for coursework delivered online or by distance learning system (AGBUC, 2013).

Governance changes require institutions to increasingly become demand-driven, affecting their core missions, management and strategies. Education is Australia's fourth largest export industry behind iron ore, coal and gold, and ahead of tourism, natural gas and crude oil, generating about $15 billion in revenue annually (ABS, 2013). Table 34 lists the 2013 figures for the top five contributing and the top five growth countries in the Australian student population. Students from these countries will present Australian HEIs with distinct adaptation and assimilation challenges.

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Table 34: Foreign student enrolment across all education sectors

Five Top Country Contributors of Foreign Student Populations (52.3%)		Five Top Countries of Growth in Foreign Student Populations (Oct, 2013)	
Peoples' Republic of China (PRC)	28.9%	Philippines	+26.3%
India	9.2%	Colombia	+19.4%
Republic of Korea	5.2%	Pakistan	+17.6%
Vietnam	4.9%	Brazil	+16.3%
Malaysia	4.1%	Taiwan	+12.6%

Both the OECD and the International Monetary Fund (IMF) classify eight of these countries as either early- or mid-level developing nations. The exceptions are the Republic of Korea and Taiwan. This is an important distinction because literature suggests that assimilation into an English-language, European-based educational culture is very challenging for students from non-European, third-world and/or Eastern countries. Many studies have chronicled the problems of long standing adaptation and assimilation stemming from cultural, social and political differences (Klein, Miller & Alexander, 1981; Liu 1984; Yan, 2006; Yingyi, Austin & Liu, 1995). At 28.8% of the total foreign student population, PRC students are a concern; with Yan and Berliner (2009) noting these may experience more problems than other students. These students' have been recognized for their exemplary performance in general curriculum attainments but their ICT skills training and their subsequent ability to engage in rigorous university studies, has not been investigated. Given the growing dependence of tertiary education on ICT across all areas of interaction, it is now time to determine if foreign students, who currently underpin the education export industry, possess the ICT skills expected by Australian universities.

Changes in measuring and improving quality, relevance and effectiveness requires the creation of a baseline of ICT skills and the assessment tools that can measure the student's entry-level ICT skills as well as their educational progress in developing the knowledge and skills needed to enter the 'knowledge society'. Present-day knowledge society is based on the increase in data creation and information dissemination that results from the innovation of information technologies (UNESCO, 2005). By definition, ICT is the driving component of a knowledge society. But the creation of a knowledge society is not necessarily complex. It can be as simple as an exchange between individuals, such as a student and a teacher, in which both parties as imbued with the need to create new knowledge. In 2012, the OECD overlooked this dynamic when it did not recognize the role of ICT or the two primary beneficiaries of ICT use: the teacher and their student. In each exchange between instructor and student a primary knowledge society is created. On a daily basis, the educator is the de-facto implementer of ICT change. The student, if adequately prepared and able to adopt to change, is the ultimate beneficiary. The university instructor's personal choice and use of ICT, the individual students' ICT skills and adaptability add up to a much larger academic configuration: the ability to partake successfully in the higher education process and enter the knowledge society. This process provides considerable justification for an ongoing assessment of how and what ICT are used in higher education.

RESEARCH DESIGN AND DATA ANALYSES

A pilot survey of student ICT skill needs at the University of Tasmania and the University of Wollongong was conducted in July, 2012. Twelve additional university systems were then selected to take part in a second survey in March, 2013. Together, these fourteen HEI represent the six Australian states and the Australian Capital Territory. Accessing public records available through each university's website, the researcher compiled an email data base of over 3,000 contacts. Of these, 401 viable responses were collected. The survey was distributed online via the UTas-provided Qualtrics Survey Software© provided to academic and professional staff. Selecting this delivery method was an intentional test of the efficacy of the data gathering process using university-recommended security and online applications. The development of this email data base and the subsequent availability of the data in both .xlm and .spss format would be considered a viable *usability study* of the various university websites.

The survey design was based on a compilation of previously conducted academic surveys instruments (Crisp et al., 2009; Davies, 2008; van Braak & Goeman, 2003). Emphasis was placed on quantitative questions using the Likert scale to allow for future comparisons. Survey content was based on the current ICT criteria for primary through secondary education in the New South Wales K-10 technology education (NSW, 2013), the Standards for Students (ISTE, 2007) and the Texas Essential Knowledge and Skills (TEKS, 2013). All aspects of the email collection, the contact methods, the online survey presentation, the data collection, maintaining the anonymity of respondents and the data analysis were pre-approved, monitored and conducted according to the University of Tasmania Social Science Human Resource Ethics Committee (HREC).

The survey included twenty-eight questions, an introduction and a closing note of appreciation. ICT skills were grouped into ten categories, based on similarities of use:

- Communication & Email;
- Content Management Systems;
- Database Management;
- Graphics Manipulation;
- Hardware;
- Multimedia Presentation;
- Online Applications;
- Data Retrieval and research;
- Spreadsheet Calculation; and
- Word Processing.

The respondents were asked to rank the importance of specific ICT skills in relation to their field of study. The Cronbach's alpha reliability coefficient (>p value) for the ICT skills questions ranged from .776 to .956 with a mean of .856. Therefore the questions were considered to be highly reliable with a high level of internal consistency since a figure of Cronbach's alpha >0.8 is taken to assure validity (DeVillis, 2003; Kline, 2005). Each question was introduced using the same general phrase "How important is it that your students have these…" and then offered from three to twelve demonstrable skills to aid in the respondent's selection. The respondent was given prompts on a Likert scale of (1) Very Unimportant; (2) Unimportant; (3) No Opinion; (4) Important and (5) Very Important. To conclude the survey, the respondent was asked to rank the value of crafting an assessment tool to measure student ICT skills and, if necessary, developing a skills remediation program for students found lacking required skills.

RESULTS AND DISCUSSION

During the analysis process the Likert prompt of *no opinion* was recoded to the value of one and the remaining responses adjusted accordingly: (1) No Opinion; (2) Very Unimportant; (3) Unimportant; (4) Important and (5) Very Important. From the data collected, Figure 9 indicates the importance placed on each of the ten categories. Educators indicated seven of the ten categories were important with Data Retrieval, Word Processing and Content Management Systems skills ranked very important.

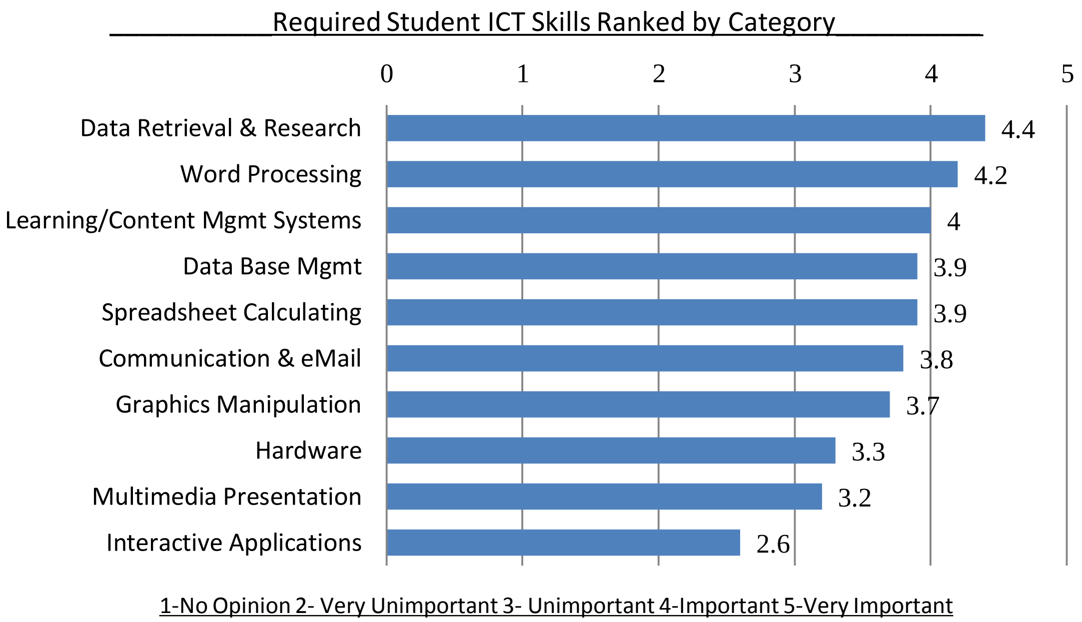

Figure 9: Ten ICT categories ranked by importance

The following three tables deconstruct the ten ICT skill categories above into the operational uses of each of the ICT skills: offline skills, online skills and hardware. Skills are considered *offline* if they existed before or do not require Internet connectivity to implement. Skills are considered *online* if they require Internet connectivity to function. These two categories include all of the skills necessary for student L/CMS interactions. These evaluations show that educator preferences were both practical in use and relevant to changes in content delivery methods. Table 35 ranks the 23 offline skills queried. Sixteen of the twenty-three ICT are ranked over 70% importance.

Table 35: Specific student offline skills required across all faculties

Offline Skills Required Across All Faculties	Yes %
Word Processing - Manipulate text	92
Word Processing - Use reference, thesaurus & language tools	87
Graphics Manipulation - Create clear, concise & logical presentations	86
Word Processing - Insert headers, footers, ToC & appendices	83
Word Processing - Work with a variety of office applications	83
Word Processing - Personalize & use spellchecker as a learning tool	82
Word Processing - Use page orientation & print layout to eliminate errors	82
Word Processing - Create boxes, borders, table, bullets & numbering	80
Spreadsheet Calculating - Understand terminology: column, row, cell	78
Graphics Manipulation - Design slide show color, type style, transitions	78
Graphics Manipulation - Insert graphics from various sources	76
Graphics Manipulation - Select/delete/crop copy in presentation formats	75
Spreadsheet Calculating - Generate graphs, charts, bar columns, lines etc.	75
Data Base Management - Understand terminology: fields, records & files	74
Spreadsheet Calculating - Use sum, formula & basic calculations	74
Spreadsheet Calculating - Format currency, time, numerical value	73
Data Base Management - Sort data, add/delete & edit records	68
Spreadsheet Calculating - Alignment & adjust column width & row height	68
Data Base Management - Create fields & choose data types	66
Multimedia Presentations - Understand importing, navigation & hyperlinks	60
Multimedia Presentations - Transition timing, sounds & editing	57
Graphics Manipulation - Work with many graphic applications	53
Graphics Manipulation - Use freehand drawing tools & color palettes	47

Four categories comprised the online ICT with twenty-four specific skills queried, each considered relevant for their role in mass communications and education. The nine skills included in the category *Interactivities* were ranked lowest of all 64 skills surveyed. This trend requires monitoring as these skills are often found providing support for multi-cultural and multi-lingual populations. These Twenty-six online skills were queried and the responses are ranked in below. Twelve of these ICT are ranked over 70% import. Table 36: Specific student online skills required across all faculties.

Table 36: Specific student online skills required across all faculties

ICT Online Skills Required Across All Faculties	Respondent %
Data Retrieval & Research - Use keywords in advanced search	95
Data Retrieval & Research - Search sites with accurate information	94
Data Retrieval & Research - Record, catalogue & cite data	93
Data Retrieval & Research - Understand browser uses	87
Data Base Management - Locate information subject, keywords & author	83
L/CMS Skills - Access learning materials	81
Communication & Email - Compose appropriate emails	80
Data Base Management - Use academic & commercial data bases	80
L/CMS Skills - Upload assignments for assessment	78
L/CMS Skills - Discuss work on bulletin boards	73
Data Retrieval & Research - Work with many applications	71
Communication & Email - Format, size and send academics	70
L/CMS Skills - Access grades for units	69
L/CMS Skills - Take a quiz	66
Communication & Email - Reproduce academic formats	58

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ICT Online Skills Required Across All Faculties	Respondent %
Communication & Email - Create, organize & store files	53
L/CMS Skills - Participate in a webinar	50
Interactivities - Social media, blogs & forums	49
Interactivities - Media streaming	43
Interactivities - Learning/Content Management Systems	42
Interactivities - Web development or editing tools	31
Interactivities - Mapping & location programs	28
Interactivities - Language translation programs	26
Interactivities - 3D or animation software	23
Interactivities - Games & gaming	13
Interactivities - Virtual worlds	11

The remaining ICT skills queried were those required to work with various hardware. Table 37 ranks respondents' evaluation of the importance of these twelve hardware.

Table 37: Specific student hardware skills required across all faculties

ICT Hardware Skills Required Across All Faculties	Respondent %
Desktop & laptop computers	98
External storage, USB & thumb drives	90
Printers, copiers & scanners	87
Modems or routers	50
Tablets or eReaders	49
Smart phones	49
Webcams or microphones	48
Wireless, Bluetooth or tethering transmitters	44
Security digital (SD) cards or readers	43
Audio recorders or players	42
Video recorders or players	40
Interactive whiteboards	33

The top three items (identified by over 70% of respondents) were clearly the most significant, with a substantial gap before the remaining hardware items.

Recommendation of Assessment and Remediation Tools

The survey also inquired about the ICT skill discrepancies and, if identified, provides remediation. Again, across all faculties, there was general agreement that such assessment and support would be advisable. However, individual faculty responses varied. Table 38 shows the percentage of respondents who consider assessment and remediation important or very important diagnostic tools. The data is offered both across all faculties and segmented into seven faculty groupings.

Table 38: Assessment and remediation recommendations

Assessment & remediation attitudes of respondents	Respondent %
Is there a need for an assessment tool to identify student ICT skill discrepancies?	60% (Yes)
Is there a need for support and remediation to address ICT discrepancies?	60% (Yes)

Table 39 indicates assessment and remediation attitudes sorted by faculty.

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Table 39: Assessment and remediation attitudes by faculty

Assessment & remediation recommendations per faculty	% Recommending Assessment	% Recommending Remediation
Arts	71%	67%
Business & Commerce	58%	54%
Education	67%	64%
Health Science	69%	62%
Library & Research	49%	46%
Social Science	69%	69%
STEM	58%	60%

The high assessment percentage expressed by the Arts faculty is of interest as it may reflect the use of emerging and creative applications into Arts curricula. Emerging ICT, such as 3D spatial design, virtual image projections, multimedia embedding, etc., may present additional challenges to students enrolling in these academic programs. Further study might be indicated in order to identify what emerging technologies students choose to enhance their learning with an eye on their future relevance across all curricula.

CONCLUSION

Moore's Law (1965) is based on the observation that, over the history of computing hardware, the number of transistors on integrated circuits doubles approximately every two years. This relationship has come to represent the rapid pace of change brought on by ICT. Keeping pace is difficult and often results in chaotic solutions. Universities strive to create students who can contribute to the knowledge society. In light of this research study, three issues that impede this goal are presented. Firstly, university decision makers do not have the timely well-supported data they require on which to base their ICT decisions. Secondly, foreign students, many from developing countries, receive limited ICT instruction and should not be expected to have the ICT skills required for rigorous university study. Thirdly, ICT usage information has not been collected from the university lecturer who is both the most influential decision maker of daily ICT use but also the person most directly affected by any inconsistencies in a student's ICT abilities as they affect classroom performance. There are many stakeholders who might benefit from this survey data. As indicated in the introduction, academic boards of directors and chief financial officers base important technology decision on data that they indicate is increasingly hard to come by. University marketers and planners could benefit from insights that arise from this data. However, this study was intended to aid two cohorts: firstly the tertiary educator, by providing awareness of an as yet unidentified adaptation issue that as many as 50% of their students may encounter; and, secondly the student-as-academic, by alerting them to one of the more easily-remediated challenges they may find when choosing their tertiary field of study outside their home country. It is the responsibility of the accepting institution to see that the foreign student has the requisite ICT skills to engage in rigorous university studies.

REFERENCES

AGBUC - Association of Governing Boards of Universities and Colleges. (2013). *Taking the board to school on educational technology.* AGBUC survey on technology and instruction. Open document. Washington, D.C.

ABS - Australian Bureau of Statistics. (2013). *International trade in goods and services.* An agenda for Australian higher education 2013-2016. Open Document. Canberra, ACT.

Crisp, G., Palmer, E., Turnbull, D., Nettelbeck, T., Ward, L., LeCouteur, A., Sarris, A., Strelan, P., & Schneider, L. (2009). First year student expectations: Results from a university-wide student survey. *Journal of University Teaching & Learning Practice. 6*(1), 3-21. DOI: 10.1007/s10734-008-9188-3

Davies G. (Ed.) (2008) Information and Communications Technology for Language Teachers (ICT4LT). Slough: Thames Valley University. Retrieved from http://www.ict4lt.org.

DeVellis, R. F. (2003). ***Scale development: Theory and applications*** (2nd ed.). Thousand Oaks, CA: Sage Publications.

Gurney-Read, J. (2014). Fear of technology may hold back change in education, says Lord Puttnam. *The Telegraph.* Retrieved from http://www.telegraph.co.uk/education/educationnews/10617593.

ISTE – International Society for Technology in Education, (2013). Standards for students. Retrieved from https://www.iste.org/standards/standards-for-students

Jaschik, S. & Lederman, D. (2013). *The 2013 inside higher ed survey of college and university business officers.* Gallup Poll conducted by Inside Higher Ed for Academic Partnerships. Washington, D.C. Retrieved from www.insidehgihered.com

Kearney, M.L. & Yelland, R. (2010). Higher education in a world changed utterly: Doing more with less. Discussion paper of the International Management in Higher Education Conference. Paris, FR: OECD.

Klein, M., Miller, M., & Alexander, A. (1981). The American experience of the Chinese student: on being normal in an abnormal world. In A. Kleinman & T-Y Lin. (Eds.), *Normal and abnormal behavior in Chinese Culture*. 387-402. Boston: D. Reidel Publishing Co.

Kline, R. B. (2005). ***Principles and practice of structural equation modeling*** (2nd ed.). New York: Guildford.

Liu, Z. (1984). *Two years in the melting pot*. San Francisco, CA: China Books and Periodicals.

Moore, G. (9165). Cramming more components onto integrated circuits. *Electronics,* April 19, 1965, 114-117.

NSW – New South Wales. (2013). Board of Studies, Teaching and Educational Standards. NSW K-10 syllabus. Sydney, NSW. Retrieved from http://www.boardofstudies.nsw.edu.au/syllabus_sc/

TEKS – Texas Essential Knowledge and Skills. (2013). Technology applications. Texas Administrative Code, Title 19, Part 2, Chapter 126. Retrieved from http://ritter.tea.state.tx.us/rules/tac/chapter126/index.html

van Braak, J. & Goeman, K. (2003). Differences between general computer attitudes and perceived computer attributes: Development and validation of a scale. *Psychology Reports. 92*(2), 655-660. DOI: 10.2466/pr0.92.2.655-660

Yan, K. (2006) The investigation of academic stress of Chinese students attending in American Universities. Paper presented at the annual conference of *American Educational Research Association*, San Francisco, CA.

Yan, K. & Berliner, D. (2009). Chinese international students' academic stressors in the United States. *College Student Journal, 43*, 939-960.

Yingyi, S., Austin, W. & Liu, W. (1995). Coping with anomic stress: Chinese students in the USA. *Deviant Behavior*, *16*, 127-149. DOI: 10.1080/01639625.1995.9967993

Appendix 2: *SurveyP-12* and *SurveyHE* Question Bank

Demographic Questions

Do you consent to completing this survey?
- ❍ Please, continue
- ❍ No, thank you

Gender
- ❍ Male
- ❍ Female

Age
- ❍ 20-29
- ❍ 30-39
- ❍ 40-49
- ❍ 50+

What is the highest educational qualification you hold?
- ❍ Bachelor's Degree
- ❍ Master's Degree
- ❍ Ed.D.
- ❍ Doctorate
- ❍ Other ____________________

How long have you been working in education institution(s)?
- ❍ Less than 1 year
- ❍ 1-5 years
- ❍ 6-10 years
- ❍ 11-15 years
- ❍ More than 15 years

In which faculty(ies) do you teach?
- ❑ Arts
- ❑ Business or Commerce
- ❑ Education
- ❑ Health Science
- ❑ Science, Technology, Engineering or Maths
- ❑ Social Sciences
- ❑ Library or research support
- ❑ Other ____________________

Please select the levels and modes of teaching in which you work.
- ❑ Under graduate
- ❑ Graduate
- ❑ Post graduate
- ❑ Distance education & online tutorials
- ❑ Research & support services
- ❑ Other ____________________

Your ICT Aptitude	Very true	Somewhat true	No opinion	Not true	Very untrue
It is easy for me to learn a new ICT	❍	❍	❍	❍	❍
I learn a new ICT best when I use it to complete a new task	❍	❍	❍	❍	❍
I shop for new ICT soon after they are available	❍	❍	❍	❍	❍
I understand cloud computing	❍	❍	❍	❍	❍
My colleagues come to me for ICT advice	❍	❍	❍	❍	❍

Your Operating System Experience	Android	Apple	Linux/Ubutu	Windows
I have experience with	❑	❑	❑	❑
I currently work with	❑	❑	❑	❑
I prefer	❑	❑	❑	❑

Your hardware and software experience	Yes	Somewhat	No
I have a smart phone	❍	❍	❍
I have a home office	❍	❍	❍
I have a home multimedia system	❍	❍	❍
My software is up-to-date	❍	❍	❍
My hardware is up-to-date	❍	❍	❍

Your Internet and cloud computing experience	Yes	Somewhat	No
I access my university accounts from off-campus locations	❍	❍	❍
I access news, entertainment and/or shopping	❍	❍	❍
I use Skype/desktop videoconferencing	❍	❍	❍
I have a social media account	❍	❍	❍
I have an avatar and spend time in virtual worlds	❍	❍	❍

How have you received ICT training in the last 12-months?

❑ On-the-job
❑ Professional development
❑ I have earned formal certifications
❑ Other ____________________
❑ I have not received ICT training

The Academic ICT Gap

What was the focus of the training you received?

- ❑ Office suites: word processing, spreadsheets and data bases
- ❑ Offline presentation skills such as those used with Microsoft PowerPoint
- ❑ Offline multimedia skills such as those used with Adobe Photoshop
- ❑ Online skills such as those used to access email and otherwise interact with others via the Internet
- ❑ Online skills necessary to locate, retrieve, sort and store research data
- ❑ Online webpage creation and design
- ❑ Your university's content management systems (CMS)

Would you like to receive (additional) ICT training?

- ❍ Yes
- ❍ No

In what areas would you like to receive ICT training?

- ❑ Office suites: word processing, spreadsheets and data bases
- ❑ Offline presentation skills such as those used with Microsoft PowerPoint
- ❑ Offline multimedia skills such as those used with Adobe Photoshop
- ❑ Online skills such as those used to access email and interact with others via the Internet
- ❑ Online skills necessary to locate, retrieve, sort and store research data
- ❑ Online webpage creation and design
- ❑ Your university's content management systems (CMS)
- ❑ Other ____________________

How do you use ICT in your teaching?

- ❑ To present new knowledge
- ❑ For drills and practice
- ❑ To communicate with students
- ❑ Provide multimedia for online and distance learners
- ❑ Formal assessments
- ❑ Other ____________________

28 ICT Items and Assessment/Remediation

Word Processing ex. Microsoft Word to create and visually present personal and academic writing
1. Select, highlight, cut/copy/paste, change type appearance, fonts, size and style
2. Create text boxes, use borders, columns, add tables, bullets and numbering
3. Use reference, thesaurus and language tools
4. Understand page orientation and document layout. Use print preview to eliminate errors

Presentation Skills ex. MS PowerPoint to create visual content, text and images
1. Understand that a presentation is clear, concise and logical
2. Choose appropriate slide design and layout considering color palettes, type size and style, transitions
3. Insert graphics from various sources e.g. clip art, digital images
4. Select/delete/crop/copy and change the size and properties of an object

Spread sheet Skills ex. Microsoft Excel to manipulate, analyses and present numerical and textual data
1. Understand terminology: column, row, cell, cell range
2. Can alignment and adjust column width and row height
3. Generate appropriate graphs e.g. bar, column, line

4. Use sum formula and undertakes basic calculations

Research & Data Management skills ex. used to develop personal reference resources or libraries?

1. Locate specific information searching by subject, key word, author
2. Select appropriate search sites and determine if information is current, accurate and reliable
3. Properly record, catalogue and cite electronic data references
4. Understand basic terminology: fields, records and files
5. Sort data, add/delete records and edit existing records
6. Properly format, size and send attachments and uses hyperlinks and navigation buttons

Online applications & tools

1. 3D or animation software
2. Language translation programs
3. Mapping and location programs
4. Social media, blogs and forums
5. Web development or editing tools

Hardware

1. Desktop and laptop computers
2. External storage drives, USB thumb drives
3. Printers, copiers or scanners
4. Tablets or eReaders
5. Webcams or microphones

As they relate to you field(s) of study, how important is it that your students can use these operating systems?

	Very Important	Important	No opinion	Unimportant	Very unimportant
Android	❍	❍	❍	❍	❍
Apple	❍	❍	❍	❍	❍
Linux/Ubutu	❍	❍	❍	❍	❍
Windows	❍	❍	❍	❍	❍

Please rank the value of the following, to the commencing student.

	Very Important	Important	No opinion	Unimportant	Very unimportant
An ICT assessment tool to identify skill discrepancies	❍	❍	❍	❍	❍
ICT skill remediation programs	❍	❍	❍	❍	❍

Please list any ICT not included above that you currently use, or are considering the use of, in your coursework. Please include emerging hardware, software and online resources.

Appendix 3: Timeline of ICT Developments East and West by Generations

ICT Developments by Generational Ages ©
Red - Chinese ICT Inventions, Green - ICT access blocked in China

		Year	ICT Developments	Western Generations	China Generations
Current Instructors	Digital Immigrants	1970	***MICRO-COMPUTER AGE*, COMPUTER ASSISTED INSTRUCTION (CIA),** UNIVERSITY TIME-SHARING SYSTEMS, FLOPPY DISK	**Gen X**: Counter-culture, Internet inventors, politically vocal, well educated, growing global awareness	**Post-70's**: Cultural revolution, academics in forced reeducation, schools closed in 1966 reopen 1977, *gaokao* reinstated, political instability through 1978
		1971	MOUSE		
		1976	***DAWN OF THE DIGITAL AGE (binary system technologies)***		
		1977	**ONLINE UNIVERSITY**, ETHERNET		
		1978	**COMPUTER LITERACY MOVEMENT (CLM), PLATO**		
		1979	CELLPHONE		
	Digital Natives	1980	**EDUCATIONAL SOFTWARE AND TEACHER AUTHORING**	**Gen Y**: Educated, use ICT tools - computers, cell phones, A/V & multimedia - efficiently, social & political activists. Similar characteristics occur in China post-2000.	**Post-80's**: *Little Emperors*, 1-child policy will transform society & economy, high illiteracy rates. No trained educators for schools. Transitional generation with no ICT awareness or access.
		1981	MS DOS		
		1982	IBM PC, AUTOCAD, LAPTOP WITH FOLDING SCREEN		
		1983	**GARDNER'S MULTIPLE INTELLIGENCES**, APPLE II, MS WORD		
		1984	CD ROM, APPLE MAC, INTRA-NETWORKS		
		1985	**INTEGRATED LEARNING SYSTEM (IL**S), MS WINDOWS, DV CAMERA		
		1987	MS POWERPOINT, MS EXCEL		
		1988	ADOBE PHOTOSHOP		
		1989	MS OFFICE SUITE		
Current Students		1990	MULTIMEDIA PCs, DIGITAL CAMERA, 3D STUDIO MAX	**Gen Z**: Globalizers, digitally connected, postmodern, live in an ICT environment which they regularly modify and personalize for education, business and social purposes.	**Post-90's**: Traditional Confucian education. Internet access severely restricted by government but some Western commercial and social media begin to filter through the Great Firewall. Financial opportunities increase as global commerce grows.
		1991	GRAPHICS PROCESSORS		
		1992	***DAWN OF THE INTERNET AGE*, CSIRO WIRELESS**, IBM LAPTOP		
		1993	WORLD WIDE WEB, eMail, PDF		
		1994	YAHOO, QUICKTIME, JPG, SPAM		
		1995	DIAL-UP INTERNET, WINDOWS 95 BROWSER, ADOBE FLASH, USB, MP3,		
		1996	HOTMAIL, GOOGLE TRANSLATE, BABELFISH		
		1997	BLOGS, BROADBAND		
		1998	**ISTE STANDARDS**, GOOGLE, AUTODESK 3D MAYA. Tencent/QQ (virtual goods & online services)		
		1999	WI-FI, MYSPACE, INTERNET MUSIC/NAPSTER. Dangdang (online shopping), Ctrip (online travel services), Alibaba (business-to-business commerce)		
		2000	**AU, CN, UK, US ISSUE EDU ICT INTEGRATION PLANS**, GLOBAL INTERNET, SMART PHONE, Baidu (search engine)	**Gen AO** (always on): Nimble multi-taskers, instant gratification, quick fixes, low on patience & deeper knowledge critical thinking skills. ICT environment complete - do not remember analogue technologies	**Post 2000's**: High educational expectations and societal pressure lead to student stress, financially secure due to parental conservatism and growing job opportunities. Heavily restricted global Internet access encourages use of Chinese-based commercial and social media. No comprehensive ICT intergration into K-12 education.
		2001	WIKIPEDIA		
		2002	AMAZON, BLACKBERRY		
		2003	LINKEDIN, iTUNES. Taobao (online shopping), Dianping (urban city entertainment guide)		
		2004	FACEBOOK, FLICKR		
		2005	gMAIL, GOOGLE EARTH, YOUTUBE. Hudong & Baike (Wikipedia clones), Sina Blog (weblogs), Renren (HE students' social networking)		
		2006	CLOUD COMPUTING, GOOGLE DOCS. Tudou & Youku (social networks)		
		2007	**ISTE INTERNET STANDARDS**, ANDROID OS, iPHONE		
		2008	**ONLINE & DISTANCE LEARNING K-12**, GOOGLE CHROME, TWITTER		
		2009	**FULLY INTEGRATED CLASSROOMS IN WESTERN K-12 EDUCATION.** Sina Weibo (social network)		
		2010	WIRELESS INTERNET INTEGRATION. Qiyi (online entertainment)		

Appendix 4: EDUsummIT Thematic Working Group 4 - Digital Inequity

Addressing Gaps and Promoting Educational Equity

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Introduction

This policy brief focuses on moving towards digital equity by addressing onsite sustainable innovation with digital technology in the classroom. With no concern for sustainability from day one, most initiatives promise results that will not be achieved (Gichoya, Hepworth, & Dawson, 2006). The absence of sustainable classroom-based innovation with digital technology is a reality in both developed and developing countries. It may be that digital tools and resources are underused given the pressures of curricular demands in developed countries (Cuban, 2015). In developing countries where digital access is still rare, once a project is over, the use of technology, if any, becomes more difficult: hardware and software become obsolete, connectivity is too expensive, technical support and professional development are lacking. In other words, more often than not, capacity building comes to a stop, and scalability does not occur (Breuleux et al., 2000; Looi & Teh, 2015).

Innovative Practices

Many innovative practices take place inside and outside the classroom. Cases from five continents, all referring to sustainability, have been reviewed using ISTE's (2009) essential conditions to effectively leverage technology for learning: 1) shared vision; 2) empowered leaders; 3) implementation planning; 4) consistent and adequate funding; 5) equitable access; 6) skilled personnel; 7) ongoing professional development; 8) technical support; 9) curriculum framework; 10) student-centered learning; 11) assessment and evaluation; 12) engaged communities; 13) support policies; and 14) supportive external context). Exemplars of these cases are available at the following URL: https://drive.google.com/folderview?id=0B3cOxtlUwbekfnhpcFpxSTRFN0hReUNnSDJ2ejRFNXpSZ1VORW5RRnVSaVJlS0hBT0YtOEk&usp=drive_web

Potential users of an innovation must accurately determine how to adapt an innovation to their setting and whether sufficient conditions for success exist to make adaptation successful (Looi & Teh, 2015, p. ix). Moreover, short-term studies that demonstrate initial success in the adoption of digital technology are not enough (Ahmad, 2015; Labonté-Hubert, 2013). Long-term implementation studies reveal that conditions change, and that new challenges arise (Laferrière, T., Hamel, C., & Searson, 2013; Passey, 2011; Sandholtz et al, 1997). Therefore, implementation needs to be monitored regularly and in ways that meet user and technology adaptation over time. For sustainability and digital equity to be achieved, long-term adaptability from technological, pedagogical, cultural, social and learning perspectives all need to be considered and in place.

Issues and Challenges for Practitioners and Policy Makers

Policy makers should give special attention to the curriculum framework framing the uses of technologies, and its alignment with implementation (e.g., ICT use in support of student-centered learning), assessment and evaluation. In spite of abundant access to technology in developed countries, curricula and testing measures are both perceived by teachers as limiting their uses of ICT (Fu, 2013). Developing curricula and testing measures, so that ICT use in the teaching-learning process becomes increasingly perceived as necessary, is a long-term challenge facing all education systems.

Such "next-generation alignment" requires that governments generate partnerships with universities, philanthropic foundations, teacher and parent associations, and businesses. Successive cycles of data-driven discussion and decision-making will be necessary, and they will likely turn into political issues when competitive demands surface.

Meanwhile, third-party organizations (e.g., foundations) that want to make a contribution (money, time, and energy) toward digital equity processes, are encouraged to produce policy guidelines that target sustainable innovation in settings of their choosing. They will have to manage their own expectations, as well as the expectations of those they want to serve. They will have to choose between long-term commitments that in some settings keep improving the level of presence of the essential initial conditions identified by ISTE to effectively leverage technology for learning ("spikes" of innovation, Florida, 2005).

The Academic ICT Gap

Spikes of innovation refer to technology use for learning that is concentrated in some areas where teachers, administrators and learners come together, grow an understanding and develop skill regarding its uses for learning. It is important for third-party organizations to understand the relevance of such spikes of innovation. Otherwise, short-term actions are likely to first seduce and later disappoint teachers and learners. In this respect, managing the 'U-challenge' (time periods when teachers are implementing uses of technologies, when their performance initially decreases due to the need to accommodate new practices and later when upgrading and review of practices occur) is important.

Digital gaps evolve because of gaps in access, adaptability, literacy and cultural limitation. Regarding content, educational software and apps are widely being developed in western countries causing the content to reflect those cultures. As a result, users in non-western countries must often learn and understand the western culture in order to gain the educational value of the resources. If these resources are developed by, or in conjunction with, individuals from the regions in which they will be used it would remove one barrier to achieving educational equity. Additionally, this practice could potentially increase job growth within this industry in the regions where the software/apps are to be implemented. Similarly, language can also act as a technological barrier. Most of the materials are in English, with non-English websites usually appealing to stereotypes in order to achieve marketability (Kalyanpur & Kirmani, 2005). Thus, it is also important to build a local community of developers who can take care of the continuity of the innovations.

Policy Recommendations

Governments or third-party organizations and their partners initiating projects are strongly advised to examine their innovation on a sustainable path towards digital equity by considering long-term adaptability, as well as referring to the ISTE initial 'essential conditions' for project conception, implementation, and evaluation.

Establishing and nurturing "spikes" of innovation through partnership. For innovation to sustain, it must be adapted to local contexts (which may need to be considered at institution, local, regional or national levels). The implementation phase must be followed by a long-term monitoring phase that identifies important issues at key points for sustainability and adaptability. The formation of implementation and monitoring practices, including committees, are necessary.

It is important to be aware that digital educational resources reflect the culture of the country/region in which they are conceptualized and produced, and thus may inadvertently create barriers for reaching global educational equity.

Building a local community of developers that will continue the innovations when the support is gone.

Materials in the local languages should be available.

Recommended Readings

Ahmad, A.K. (2015) A Delphi Study: Technology Leadership Network's Perceptions of ISTE Essential Conditions for Technology Integration in Professional Learning Communities. *Doctoral dissertation,* Brandman University, Irvine, CA. Retrieved from: http://pqdtopen.proquest.com/doc/1680017634.html?FMT=ABS

Ball Anthony, A. (2012) Activity Theory as a Framework for Investigating District-Classroom System Interactions and Their Influences on Technology Integration. *Journal of Research on Technology in Education, 44(*4), 335–356.

Banister, S., &; Fischer, J. (2010) Overcoming the Digital Divide: The Story of an Urban Middle School. *Mid-Western Educational Researcher, 23*(2), 2-9.

Breuleux, A., Laferrière, T., & Lamon, M. (2002) *Capacity building: Research and development into the effective uses of ICT*. Paper presented at the Pan-Canadian Education Research Agenda Symposium ''Information Technology and Learning'' April 30 – May 2. Montreal, Quebec. Retrieved from: http://www.cesc.ca/pceradocs/2002/papers/ABreuleux_OEN.pdf

Cuban, L. (2015) The lack of evidence-based practice: The case of classroom technology. Retrieved from : https://larrycuban.wordpress.com/2015/02/05/the-lack-of-evidence-based-practice-the-case-of-classroom-technology-part-1/

Florida, R. (2005) The world is spiky. Retrieved from: http://www.theatlantic.com/past/docs/images/issues/200510/world-is-spiky.pdf

Fu, J. S. (2013) ICT in Education: A Critical Literature Review and Its Implications. *International Journal of Education and Development using Information and Communication Technology (IJEDICT),* 9, (1), 112-125.

Gichoya, D., Hepworth M., & Dawson R. (2006) Factors affecting the success and failure of government ICT projects in developing countries. *Proceedings of the 2nd International Conference on E-Government.* Dublin, Ireland.

ISTE's 2009 Essential conditions. Retrieved from: http://www.iste.org/standards/essential-conditions

Kalyanpur, M. & Kirmani, M.H. (2005) Diversity and Technology: classroom implications of the digital divide, *Journal of Special Education Technology, 20*(4), 9-18.

Labonté-Hubert, A. (2013) Les manifestations de transformation dans l'activité d'intégration du Knowledge Forum et de VIA dans la classe pléthorique burkinabè. Mémoire de maîtrise, Université Laval, QC, Canada.

Laferrière, T., Hamel, C., & Searson, M. (2013) Barriers to Successful Implementation of Technology Integration in Educational Settings: A Case Study. *Journal of Computer-Assisted Learning, 29*(5), 463-473.

Looi, C.-K., & Teh, L.-W., (Eds.) (2015) *Scaling educational innovations.* Springer.

Passey, D. (2011) Implementing learning platforms into schools: an architecture for wider involvement in learning. *Learning, Media and Technology, 36*(4), 367-397, DOI: 10.1080/17439884.2011.592496

Sandholtz, J., Ringstaff, C., & Dwyer, D. (1997). *Teaching with technology: creating student-centered classrooms*. New York: Teachers College Press.

Appendix 5: *SurveyHE* interview outline sample

Q. First question... What was it that prompted you to offer to make further comments about the survey content?

A. I have been concerned about student ICT skills for a long time. It is an issue that is escalating and I believe you have created an important survey addressing this issue. I have recent experience with the discrepancies in ICT skills between the foreign and domestic students. We are currently developing a program in [Asia] that works with the domestic student. At the present they have their own ICT infrastructure and their own CMS, but it will not always be that way. We may find that when we begin absorbing their program into our own that more tech skills and more advanced CMS skills will be necessary.

Q. (Q6/7) You teach undergraduate, post graduate and online/distance students. Are you satisfied with the basic computer skills your new students bring to your courses or must you conduct remedial computer training for them outside the parameters of your normal teaching? Is this also the case with your online/distance students? Do their ICT skills impact their success rate or retard their initial interactions with online learning? Do you have more domestic or foreign students enrolled in your on-campus courses?

A. In my courses the students are primarily domestic. I estimate at least 30% of them require extra tutelage in ICT skills. Online course require basic entry level skills and most of the student either have them or get up to speed very quickly. It is hard to say how many would not succeed if they were left to develop their course communications skills entirely on their own. They must be able to use multi-media to document their required field-work. Many think they are prepared because they can use their iPads and smart phones. But social media skills do not translate and it frustrates many of them to realize how much they still have to learn. Of course, there is always a percentage that is well-versed in ICT. This is true in any community: there are those people who are comfortable with technology and value knowing what it can do for them, they are easy to teach and often become advocates themselves; there are people who, with a little coaxing, learn to perform adequately enough to be rewarded; and then, there are those who live in fear of the technology and require an inordinate amount of time to adapt, if ever. As a teacher I can work with this last group and most, if not all, will develop but it cannot be done without individual focus.

Q. (Q8-11) You are computer-savvy and obviously not intimidated by new technology… not afraid to hit 'ENTER'. Were you always comfortable with computers or is it because of your involvement in online courses and distance learning? How to you feel about the efficacy of online learning as it currently exists?

A. I have been using technology since….. both as a classroom and music teacher. I began manipulating computer applications to fit my needs a long time ago. I was fascinated by computers for learning, excited *by the newest-thing on the block. I guess my affection and affinity for computers comes from many years of positive use.*

Q. (Q12-17) You indicate that your professional development (PD) has occurred 'on-the-job' and that you would welcome PD in developing online learning materials. This area of curriculum development is often dependent on a university's learning and content management system (L/CMS). Are you satisfied with your university L/CMS system's ease-of-use for both its teachers and its students? If not, what areas would you improve?

A. It's not difficult but not everyone approaches computer learning the same way. As I said previously, there are predictable learning groups amongst the teaching population: those that eagerly accept technology and those that need more direct instruction. When computer courses are offered to the general population, there is not enough emphasis on the pedagogy behind the instruction. There is little emerging pedagogy to support it. Not only how do we use it today, but how do we continue to use it better in the future. The pedagogy needs to be better addressed.

There are technical issues that could be better addressed. Formatting is an issue that is often not addressed and can become a practical consideration. I believe it is one of the areas your study is designed to address; these often overlooked skillsets that make a cumulative difference on the whole system.

Q. (Q18-Q27) You agreed with the majority of your colleagues surveyed and recognized the importance of a broad range of basic ICT skills. (Q30) However, you indicated the added importance of digital cameras. Why is this particular hardware (or multimedia in general) important to your course work?

A. It is a component of my curriculum. For example: The use of the digital camera in creating a record of the student's work implies a certain level of ICT skill. Many students believe their use of social media qualifies them to use other types of multimedia efficiently. But it does not. First it requires an understanding of the organizational process distinctive to the audio and video media. Then the student must learn video and audio production skills….. The digital camera requires only rudimentary skills but, non-the-less, these are not analogous to social media skills. When the finished project is ready to be submitted online there are formatting considerations such as file size and resolution amongst others.

Q. (Q9 vs. Q28) Secondary schools are now using a range of operating systems (OS), their choices often driven by the availability of programs such as those used in distance/online learning. Apple OS is often chosen because of its perceived ease-of-use. However, you personally prefer Android and Windows OS. Any comment on the value or variety of OS in education?

A. I used Apple OS early-on but Windows has evolved to be a broader-based educational system. Apple is *probably more appropriate for certain fields of study and specialties, such as music and the arts. Successful students should be well-versed in both. The wider the range of tech options the more the student and teachers will find their institution setting limits on what can be realistically supported. Again, there is an issue of the universities establishing pedagogy that supports its technology. Most programs that are introduced, regardless of the OS, will do many more educational tasks that those it is used for by the average teacher or student. The methodologies on how to maximize the use is just not provided.*

Q. (Q29) Would you support the use of an ICT assessment too and the provision of remedial courses to bring students skills up to university standards? And, are there any other extenuating circumstances to which you might attribute differences in ICT skill levels such as : culture, language, country of early education or just techno-fear?

A. Yes, an assessment tool would be an excellent benefit for both teachers and students. But it must be an administrative solution to provide remediation to university standards. It would follow that the teachers would also be trained to a higher standard as well. I said in previous answers, in every cohort one must expect a wide range of learning habits and challenges. As professional educators we are all prepared to identify and accommodate this range of differences in our students. But this does not seem to be the case when universities introduce new technologies to their educators. It almost seems that the administrators forget or overlook what a diverse group their educators are. Many people, students and teachers, exhibit 'techno-fear' making it difficult to have an affinity for or intuitively use computers. This is not related to age, culture, or language-based. It is a learning challenge. Learning issues are stressing and time consuming. I'm not sure the university administrators are prepared to recognize the amount of effort computer training actually requires.

There may also be another factor. Many of the personnel at my university, about 50%, are sessional staff. They are often not provided technology professional development opportunities during the workday and paid for by the university. Hence they are reluctant to become trained on their own. This would be an easy issue to address as it would seem that if the institution requires a certain skill level to perform then they should be prepared to provide training and support.

THANK YOU

Appendix 6: Commercial and educational assessment tools

Name/Source	Scope	Pros	Cons
ATC21S ICT literacy learning in digital networks - University of Melbourne	The ATC21S study will assess learning in digital networks from 2011.	1.) Could be modified to develop a pre-commencement tool 2.) Applicable to both formative and summative use 3.) Easy to adapt for international audiences 4.) Can be applied to teachers and administrators 5.) Can be modified for bespoke and RPS testing.	1.) Most effective when used with adequate online resources to enable full student collaboration within the test groups 2.) Commercial interests have modified the level of expectations included in the original version of this unstructured assessment tool.
EAA (Educational Assessment Australia) & CSA (Computer Skills Assessment) - NSW Dept. of Education	K-12 and pre-commencing students; teachers & administrators. It targets ICT skills such as information seeking, retrieval, production, communication and evaluation skills. It is a LAN based system which embeds auto-scoring and reporting.	1.) Based on accepted NSW academic standards 2.) Used by domestic and international pre-commencing students 3.) Requires online basic online connectivity to complete tests.	1.) Limited test dates may inconvenience international markets with varied academic calendars 2.) Not customizable 3.) Results may not be as comprehensive as some school students, teachers and administrators require.
SAILS (Standardized Assessment of Information Literacy Skills) - Kent State University	SAILS is a multiple-choice questions assessment of information literacy skills covering search, evaluation and documentation of information sources.	1.) Based on accepted US literacy standards 2.) Used by over 200 HE schools to vet commencing students 3.) Requires online basic online connectivity to complete tests.	1.) Limited test dates may inconvenience international markets with varied academic calendars 2.) Not customizable 3.) Results may not be as comprehensive as some school students require.
Skill21- edtech systems	Skill21 offers online interactive assessment items which simulate tech literacy situations. Aligned to ISTE standards.	Defines 6 critical areas: informational literacy; collaboration; communication; creativity & innovation; problem solving; and, responsible citizenship.	Geared to US academic models and may not be applicable or adaptable to international models and/or reflect instructional content.
SmarterMeasure Learning Readiness Indicator - Smart Services©	Assesses a range of skills and traits required for online learning or participation in technology-rich courses in both higher education & secondary education version.	Offers a wide-range of cognitive and non-cognitive assessments what may appeal to a school or district seeking comprehensive information.	Offers broad range of assessment areas and may not focus on the ICT and RPS skills required for the HE level.

NETS (National Educational Technology Standards) - ISTE (International Society for Technology in Education)	Benchmark tool developed in 1998 to establish basic technology standards in US schools. Provides ICT assessment standards for students, teachers, administrators and coaches at all instructional levels. Adds new cohorts as they become relevant.	Has provenance in the ICT assessment field. Continues to add comprehensive skills for all educators. Can be compartmentalized and used in an international context. Good assessment guide for pre-commencing students enrolling in Western universities.	Has a fee-based structure that may place it out of reach for comprehensive use in developing countries or by individuals seeking to assess their own ICT skills.
MOUS - Microsoft Office Users'	Formal certification course resulting in business-ready MSOffice skills	Scaffolds all MS applications	N/A
ICDL - International Computer Drivers' License	Verified certifications offered across a range of basic and bespoke ICT for business, commercial and academic use.	Verified certifications offered across a range of basic and bespoke ICT for business, commercial and academic use.	N/A
PIAAC – Program for the International Assessment of Adult Competencies	Verified certifications offered across a range of basic and bespoke ICT for business, commercial and academic use.	Verified certifications offered across a range of basic and bespoke ICT for business, commercial and academic use.	N/A

(ablemetrics, 2015, retrieved from :http://www.assessmentfocus.com/ict-literacy.php)

Appendix 7: *SurveyP-12* Demographic question responses

The *SurveyP-12* collected the following data between October 2013 and February 2014. Qualtrics Survey Software© recorded 134 completed anonymous responses. The majority of the respondents were well-educated, experienced and mature educators. The majority fell within the age-range of digital immigrants (born before 1970) and, according to Prensky (2001), might be expected to have less developed ICT skills than colleagues or students born after 1970. However, the demographic data did not support that contention. Table 40, Table 41 and Table 42 show the gender, age, education level and teaching experience of the *SurveyP-12* respondents.

Table 40: Gender and age of IST survey respondents

Male	Female	20-29 years	30-39 years	40-49 years	50+ years
45%	55%	11%	28%	23%	38%

Table 41: Highest education level completed

High School	Bachelor's Degree	Master's Degree	Ed.D.	Ph.D.
3%	32%	49%	3%	13%

Table 42: Years of teaching experience

Less than 1 year	1-5 years	6-10 years	11-15 years	More than 15 years
6%	12%	25%	15%	43%

The majority of the respondents had a home office and maintained their software. That only 70% had a smart phone was of interest given the growing popularity of the device across all age groups. There was a fairly equal distribution of information and communication usage with a high propensity of voice-over-Internet-protocol (VOIP i.e. Skype) usage. These ICT allow an expatriate to cost effectively maintain their global contacts. The low incidence of avatars and virtual world participants may be due to the low number of younger-aged respondents. Virtual involvement across all age groups may be any area that increases as the use of multimedia ICT coursework increases. This would be an interesting area to monitor in relation to emerging technologies. Table 43 indicates the percentage of respondents' affirmative answers sorted from highest to lowest.

Table 43: Personal ICT use

Personal ICT Use	Yes %
I have a home office	96%
To access news, entertainment and/or shopping	94%
To access my university accounts from off-campus	85%
To use Skype/desktop videoconferencing	84%
I have a social media account	83%
My software up-to-date	81%
I have a smart phone	70%
My hardware is up-to-date	69%
I have an avatar and spend time in virtual worlds	15%

The Academic ICT Gap

Multi-nationalism is also a factor in the international learning environment. Where native English speakers were once in demand, preferences for native language and multi-lingual speakers are now common. The respondent's native language was requested in lieu of their home country as most countries have heterogeneous populations making it difficult to equate any country with a specific ethnic background. English speakers made up 64% and Mandarin Chinese speakers 17%. In all the respondents represented seventeen of nineteen global languages families. Figure 10 indicates the language family breakout.

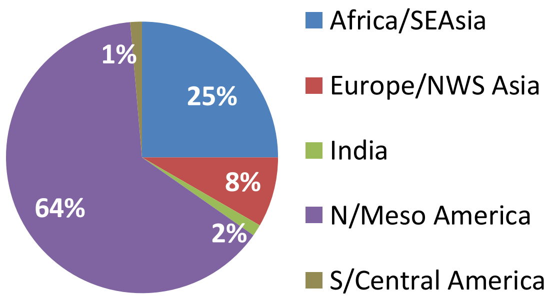

Figure 10: Chart of native language families represented

Figure 11 is a chart of the respondents teaching locations in during the five years previous to the survey.

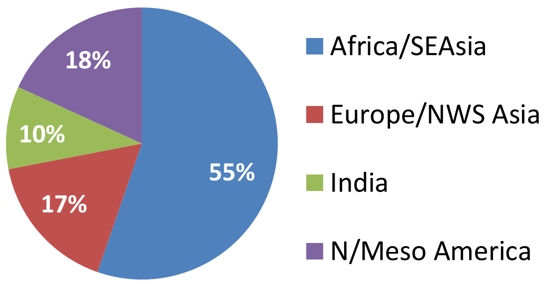

Figure 11: Chart of teaching location in the five years previous to survey

Teaching experience according to facility type was questioned. Describing preparatory schools by association with the students' intended post-secondary schooling provided an additional prompt to help the teacher choose the appropriate response. Table 44 shows respondents' teaching experience for the five years prior to this survey.

The Academic ICT Gap

Table 44: Teaching facilities in the five years prior to survey

Teaching Facilities and Curriculums	Yes %
Private Int'l Schools - preparing for foreign universities	42%
Public/private academy with specialty curriculum	31%
Government Schools - preparing for domestic universities	26%
Private domestic Schools - preparing for domestic/foreign universities	21%
Government Int'l Schools - preparing for foreign universities	15%
Vocational Schools/Programs - preparing for careers	6%

Growth in international education increases the demand for international teachers and, in turn, offers them opportunities to move vertically and horizontally within foreign education systems: options that might not be possibly in more regimented domestic systems. The following two tables represent this flexibility by providing a breakdown of their teacher certifications and the curriculum they have taught. Table 45 provides a breakdown of the five general certifications areas common to international teaching. Chinese National certification was listed separately from other Native or National/State certifications. In PRC national schools, non-native teachers may supplemented PRC teachers in certain fields, most commonly English and occasionally STEM subjects. But a PRC teaching certification was required to be a teacher-of-record in a domestic Chinese school. Conversely, international schools in China, employed PRC certified teachers in specific curricular areas such as Asian languages and some STEM teaching.

Table 45: Teachers' certifications

National Teacher Certification Type	**Yes %**
Native National/State	45%
English ex. TEFL, ESL	40%
Curriculum ex. AP, IB, IGCSE	22%
Chinese National	12%
Vocational ex. TAFE, VET, CATE	3%
None	3%

It has been observed that English study and ICT skills also go hand-in-hand and that deep language learning is enhanced by mastery of such skills (Chauhan et al., 2013, p. 406; Xueqin, 2011, p. 5). ICT are of considerable importance for university students entering STEM, where digital icons, symbols and non-verbal cues can supplement written English and enhance student learning. It is noteworthy that 100% of the respondents have experience in teaching English-language curriculum and 52% have experience in STEM subjects. The two categories with the greatest number of respondents were also the two areas of high priority to Western academics: English language and STEM. In Table 46, the respondents' experience across the seven faculty groups provides an interesting insight.

Table 46: Teachers' experience by faculty group

Arts	**Admin/ Support**	**Asian Language**	**English Language**	**Research & Data**	**Social Science**	**STEM**
10%	7%	5%	100%	3%	33%	52%

The Academic ICT Gap

For those teachers that have ICT classroom access, how they use ICT is of primary interest. Research indicates that instructors only advance ICT use when they believe the ICT is applicable to the curriculum and that they are proficient in the required ICT skills. As Kumar (2008, p. 558) states in order to provide an ICT enhanced education, the teachers must be well trained about ICT tools. There are also studies showing that teachers' ICT capability is an important issue in order to integrate it into curriculum (Pope & Golub, 2000; Albirini, 2006). If the students' ICT skills reflect the instructors ICT skills then it could be expected that these skills would remain consistent over the P-12 years. However, Table 47 indicates the opposite may be true. The use of ICT escalates in the higher grades with university level holding at approximately the same level as the final high school years. Another speculation is that ICT availability is greater in the middle and senior years' programs.

Table 47: Professional ICT use

Professional ICT Use	Elementary	Middle	Senior	HE/Adults
Present new knowledge	23%	31%	63%	64%
Communicate with students	23%	28%	57%	58%
Drills and practice	18%	19%	37%	39%
Formal assessments	16%	21%	34%	39%
I do not use computers	2%	1%	3%	1%

Table 47 also indicates that presenting new knowledge is the most common ICT use and is followed closely by communicating with students. However, there is a considerable drop in ICT use for drills, practice and formal assessments. Again, this may indicate what ICT is available for classroom use. For example, a single whiteboard or overhead projector is adequate to present new knowledge and handheld devices can be used for basic communication. But, to effectively conduct drills, practice or formal assessments using ICT, each student should have individual hardware access, such as in a computer lab. Emerging technology such as cloud computing may provide P-12 educators with cost-effective options such as bring-your-own-device (BYOD). Such initiatives may require prohibitive investments in development of delivery systems, curriculum creation, planning and teacher training. At the time of this survey, many teachers remained dependent on the stationary PC systems provided in the traditional classroom environment.

For international teachers PD focused on ICT may not be a priority and could result in outdated or inadequate ICT skills for those teachers with long international postings. Table 48 lists four ways in which these respondents received ICT training. The 26% of teachers who have earned formal ICT training almost offset the 24% of teachers who have no ICT training.

Table 48: ICT training acquisition

How ICT Skills were Acquired	Yes %
Learned ICT on-the-job	72%
ICT professional development course	41%
Earned certification separate from work	26%
I have had no ICT training	24%

The Academic ICT Gap

Table 49 indicates the respondents' past experience, current use and overall preference of OS. This indicates that Windows OS continues to dominate in both teacher experience and present use. This may be due to Windows OS affordability and the range of applications used for both business and education purposes. As the first system introduced into many developing countries Windows OS allowed administrators access to local Internet providers and financial institutions. The percent of educators who have experience with Apple OS (62%) is approximately the same as those who prefer Windows OS (61%). It is interesting that the number of teachers who prefer Apple OS is actually a bit lower than the number who currently uses the OS. This could be due to inadequate training; a lack of proprietary software or other reasons as Apple OS is marketed as an academically-friendly system and actively promotes its 1-2-1 laptop programs in international schools. The overall cost of Apple OS and its peripheral systems may prohibit its use in schools in developing countries.

Table 49: Operating systems experience, use and preference

Operating System	I have used	I am using	I prefer
Android	31%	16%	8%
Apple	62%	47%	42%
Linux	14%	5%	3%
Windows	94%	75%	61%

Appendix 8: ***SurveyP-12*** **Principal Components Analysis Total Variance Explained**

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	15.289	54.602	54.602	15.289	54.602	54.602
2	2.561	9.147	63.749	2.561	9.147	63.749
3	1.908	6.816	70.565	1.908	6.816	70.565
4	1.428	5.099	75.664	1.428	5.099	75.664
5	1.314	4.693	80.357	1.314	4.693	**80.357**
6	.896	3.199	83.556			
7	.655	2.338	85.894			
8	.527	1.881	87.775			
9	.452	1.616	89.390			
10	.363	1.296	90.686			
11	.319	1.140	91.826			
12	.304	1.085	92.911			
13	.259	.923	93.834			
14	.237	.847	94.682			
15	.193	.689	95.371			
16	.183	.652	96.023			
17	.178	.637	96.659			
18	.162	.579	97.239			
19	.139	.496	97.735			
20	.131	.469	98.204			
21	.114	.405	98.609			
22	.094	.336	98.945			
23	.075	.268	99.213			
24	.059	.211	99.424			
25	.058	.206	99.630			
26	.046	.164	99.794			
27	.031	.110	99.905			
28	.027	.095	100.000			

Extraction Method: Principal Component Analysis.

Appendix 9: *SurveyHE* demographic question responses

The University Educators' (*SurveyHE*) Survey respondents represented 12 Australian university systems. Genders were almost equally represented: males 55% (194) to females 45% (159). The age ranges skewed heavily towards the digital immigrant respondents with over 80% of the respondents over 40 years of age. Seventy percent (247) hold Doctorate degrees and 56% (197) have taught for over 15 years. These statistics imply that the majority of the respondents had experience with both traditional teaching and emerging ICT. Table 50, Table 51 and Table 52 indicate the respondents' gender, age, educational level and years of teaching experience

Table 50: Gender and age of *SurveyHE* respondents

Male	Female	20-29 years	30-39 years	40-49 years	50-plus years
55%	45%	1%	15%	27%	57%

Table 51: Highest education level completed

Bachelor's Degree	Master's Degree	Ed.D.	Ph.D.
6%	22%	2%	70%

Table 52: Years of teaching experience

1-5 years	6-10 years	11-15 years	15-plus years
6%	19%	19%	56%

ICT aptitude and interests were queried and the results indicated the respondents preferred a mix of new and old ICT. For example: only 76% had smart phones yet over 90% had home offices with hardware and software up-to-date. This may indicate a dependence on their university office systems for more advanced ICT. Table 53 reflects their responses.

Table 53: *SurveyHE* respondents' personal ICT aptitude and interests sorted by percentage

Personal ICT Use and Interests	Yes %
My software up-to-date	92%
I have a home office	91%
My hardware is up-to-date	91%
ICT learning is best based on a relevant task	86%
It is easy to learn a new ICT	86%
I have a smart phone	77%
I understand Cloud Computing	71%
I have a home multimedia system	67%
Colleagues consult me with their ICT question	56%
I buy new ICT when available	36%

Respondents were asked how they used ICT for gathering information and communicating with others. These skills ranked uniformly high across all age groups in three of the five areas queried. In the use of social media, having an avatar and visiting virtual worlds, the two youngest age groups exceeded the older groups. Table 54 presents these figures by age group.

Table 54: Personal ICT use by age group

Personal ICT Use by Age Group	20-29 years	30-39 years	40-49 years	50+ years
Access my university accounts	100%	97%	98%	98%
Access news, entertainment, shopping	100%	97%	96%	96%
Skype/desktop videoconferencing	83%	93%	91%	91%
I maintain a social media account	100%	85%	71%	71%
I have an avatar in a virtual world	33%	18%	8%	9%

Experience and use of the various OS indicates a familiarity with computer systems across formats. It is possible that an instructor's field of study may influence their personal OS experience and choices. For example, Linux OS lends itself to the teaching of computer coding. Android OS has similar benefits and is becoming more popular for use with emerging technologies and with hand-held hardware. STEM fields may use Linux, Android, Windows and/or Apple/MAC when their work requires user-interface or technical design components. Windows OS may be preferred by those with business and commerce interests; those who work with desktop office applications or *crunching numbers:* the functions Windows OS was initially designed to perform. Design- or multimedia-based teaching fields, such as the arts; often prefer Apple/MAC OS. Respondents were asked to rank their personal experience, use and preference of the four most popular OS. Table 55 indicates these responses sorted by age groups. Again, respondents were allowed multiple choices.

Table 55: Operating systems experience, use and preference by age

Operating System		Age 20-29	Age 30-39	Age 40-49	Age 50+
Android	Experience	67%	43%	38%	26%
	Use	33%	26%	28%	14%
	Preference	33%	16%	11%	4%
Apple	Experience	100%	77%	71%	67%
	Use	50%	56%	48%	55%
	Preference	17%	38%	36%	39%
Linux	Experience	33%	34%	13%	22%
	Use	17%	16%	13%	10%
	Preference	17%	15%	12%	8%
Windows	Experience	100%	92%	79%	85%
	Use	83%	82%	71%	73%
	Preference	67%	52%	46%	50%

Three questions were asked regarding the respondents' PD experience in the five years previous to the survey: how past PD had been delivered; the PD subject matter; and, their interest in future PD. Table 56 reflects their responses to PD questions.

The Academic ICT Gap

Table 56: Percentage and methods of ICT training acquisition

How ICT Skill Acquired	Yes %
I learned ICT on-the-job	52%
I had ICT professional development courses	20%
I earned formal certification separate from my work	4%
I am self-taught	3%
I welcome targeted ICT training in the future	54%
I have had no ICT training in the previous five years	47%

Interest in additional PD was almost equally split with 47% (164) declining and 52% (184) requesting more. Those who expressed an interest in additional training were asked what content should be offered. Website design was the most requested area, followed by multimedia production and research skills. The high rate of past L/CMS training may reflect the period when the introduction of online and distance curriculum delivery systems was most aggressive. Following this period, developing website and multimedia skills would complement advanced L/CMS as well as other curriculum design areas. Table 57 indicates the past and future ICT training interests of all the university staff respondents.

Table 57: Percentage of interest in ICT training areas – past and future

ICT training areas	Training received	Training requested
Desktop Office Applications	9%	14%
Graphics Manipulation	6%	10%
Multimedia Presentations	5%	20%
Communications & eMail	13%	5%
Data Retrieval & Research	14%	20%
Website Design	10%	26%
Learning/Content Management Systems	26%	11%

Respondents were allowed to enter multiple responses to the informative questions in order to reflect their cross-curriculum, -level and -platform teaching responsibilities. For this reason the total number of responses often exceeded 353. Respondents were provided a selection of seven faculty subgroups. Table 58 shows a frequency analysis of faculty distribution by age. Multiple answers were allowed.

Table 58: Number of respondents sorted by age and teaching faculty

Age	Arts	Business & Commerce	Education	Health Science	Library & Research	Social Science	STEM
20-29	2	1	1	0	1	2	0
30-29	7	7	3	5	5	9	28
40-49	13	20	6	8	5	10	42
50+	32	42	18	24	14	18	74

The questions addressing the respondents' range of teaching levels and modes offered 5 options. Table 59 lists this data. It is interesting that the number of responses is over twice the number of respondents, indicating considerable cross-level and cross-mode teaching experience.

The Academic ICT Gap

Table 59: Percentage of respondents sorted by teaching level/mode of delivery

Teaching Levels and Delivery Modes	Yes %
Undergraduates	86%
Graduate courses	43%
Post-graduates	71%
Distance/online	31%
Library and research specialists	32%

Respondents were asked how they used ICT in teaching. These responses may also indicate an increased dependence on L/CMS. The low response rate for conducting drills and practice may indicate that these tasks do not fit within the L/CMS format or that preparing to conduct these tasks via L/CMS is not a timely venture. Table 60 divides ICT teaching methods into age-based subgroups.

Table 60: Percentage of respondents sorted by ICT use per age groups

ICT Use per Age Group	20-29yrs.	30-39yrs.	40-49yrs.	50+yrs.
Present new knowledge	80%	90%	86%	86%
Communicate with students	100%	96%	88%	90%
Drills and practice	40%	33%	37%	26%
Formal assessments	67%	49%	57%	51%
Online & distance learners	60%	52%	57%	51%

Appendix 10: *SurveyHE* Principal Components Analysis Total Variance Explained

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.122	25.437	25.437	7.122	25.437	25.437
2	2.391	8.539	33.976	2.391	8.539	33.976
3	1.920	6.855	40.831	1.920	6.855	40.831
4	1.719	6.140	46.971	1.719	6.140	46.971
5	1.531	5.469	52.440	1.531	5.469	52.440
6	1.249	4.460	56.900	1.249	4.460	56.900
7	1.184	4.230	61.130	1.184	4.230	61.130
8	1.125	4.020	65.150	1.125	4.020	**65.150**
9	.881	3.147	68.297			
10	.812	2.899	71.196			
11	.754	2.692	73.889			
12	.745	2.659	76.548			
13	.697	2.489	79.037			
14	.641	2.291	81.328			
15	.590	2.107	83.435			
16	.572	2.044	85.479			
17	.552	1.970	87.449			
18	.502	1.794	89.244			
19	.432	1.544	90.788			
20	.417	1.489	92.277			
21	.388	1.387	93.664			
22	.359	1.281	94.945			
23	.335	1.197	96.143			
24	.292	1.044	97.186			
25	.269	.961	98.147			
26	.220	.786	98.933			
27	.166	.591	99.524			
28	.133	.476	100.000			

Extraction Method: Principal Component Analysis.

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Appendix 11: International Conference on Technology in Education – Paper Presented Rethinking Foreign Students' ICT Skills ISTE January, 2015, Hong Kong Polytechnic University

Appendix 12: Best-practice criteria of a formative assessment structure

Effective formative assessment of 21st Century skills should:		Example
Focus on 21st century skills and content (as defined by the P21 Framework)	21st century subject matter includes, in addition to the standard core subjects, important areas of study such as global awareness, civic literacy, etc., and skills, such as ICT literacy, critical thinking, problem-solving, and life skills.	The Intel Education Assessing Projects tool is a database of assessments of hard-to- measure 21st century skills like critical thinking and creativity.
Make thinking visible by revealing the kinds of conceptual strategies a student uses to solve a problem.	Complicated, multi-dimensional, real-world solutions rarely require mastery of a single, isolated skill or understanding of a single subject matter. Thus, a 21st century assessment must be able to measure or observe a student's mastery along several different axes. In addition, assessing student work using established rubrics and checklists is important. Not all assessments need to be formal and published.	mClass: Math diagnostic software provides insight into students' mathematical thinking.
Be structured so that educators can identify the background knowledge a student used to solve each problem in real-time.	This will help measure and clarify students' knowledge-base and procedural proficiencies.	IMMEX is a problem solving assessment software in which students are presented with a problem, and can access a palette of menu options to extract information to solve the problem. The program keeps a record of the choices each student makes.
Be largely performance-based and authentic, calling upon students to use 21st century skills.	Students need to hone the ability to apply content knowledge to critical thinking, problem solving, and analysis tasks throughout their education, as well as understand that successful learning is as much about the process as it is about facts and figures. In addition, tasks should mirror real-world situations as much as possible, so that students gain valuable training that will prepare them for success in their future endeavors. Authentic assessments use data and performance criteria that are related to the students' projects.	TerraNova Performance Assessments offer extended, open-ended tasks that measure knowledge and critical process skills in Reading, Language Arts, Writing and Mathematics. They present realistic scenarios and offer students an opportunity to demonstrate knowledge in unique ways.
Generate data that can be used to directly inform instructional practices.	Evidence from formative assessment must be used, not just collected. Teachers need to be able to understand what the assessment can reveal about the student's thinking in order to adapt their teaching to meet students' needs. By discovering the background knowledge, integration, or conceptual strategies that students may not have mastered, a teacher can identify the skills that need further work to adjust his/her teaching.	Princeton Review's formative assessments are designed to be administered frequently and results are reported in a timely fashion and include an actionable analysis to help teachers interpret results.
Aim to build capacity — both teachers' and	Both teachers and students should learn from formative assessments. Before a lesson is concluded, these assessments can show where further teaching and	DIAGNOSER is an interactive web-based program that provides feedback to students as

students'.	learning is needed, so teachers can discover ways to help students integrate 21st century skills and knowledge into their learning, thereby building pedagogical methods and student ability.	they work through their assignment. Teachers can view reports details of students' thinking about assigned topic to use to target specific problem ideas.
Be part of a comprehensive assessment continuum.	21st century skills assessment must be ongoing. Students must visualize their thought process and how it aligns with a strategy to solve or complete a problem. Since students' thought constructs are continually changing, formative assessment should be regularly given so students can see improvements in their skills and strategies, as well as knowledge transfer to parallel or related problems.	BioLogica activities monitor students' performance and collect their investigations into electronic portfolios for later evaluation and assessment. They enable students to progress at their own pace, and help the teacher to identify "teachable moments."
Reflect an understanding of learning as multidimensional, integrated, and revealed in performance over time.	Formative assessments should relay to the student that high-quality education involves a process of knowledge integration, processing, and performance. Students can then focus on learning and integrating 21st century skills to allow them to conceptualize and think about problems, rather than divert focus only to procedures and answers.	The Full Option Science System requires that students produce a body of work related to their science investigations. Progress is assessed using teacher observation, anecdotal notes, student interviews, and student written work.

(P21stCentSkills, Partnership for 21st Century Skills e-paper, 2006, p. 3)

Appendix 13: ICT Integration Survey - teachers and staff

Developing an ICT Baseline

Q1 Gender
- ❍ Male
- ❍ Female

Q2 Age
- ❍ 20-29
- ❍ 30-39
- ❍ 40-49
- ❍ 50+

Q3 What is the highest educational qualification you hold?
- ❍ Bachelor's Degree
- ❍ Master's Degree
- ❍ Ed.D.
- ❍ Doctorate
- ❍ Other ____________________

Q4 How long have you been working in education?
- ❍ Less than 1 year
- ❍ 1-5 years
- ❍ 6-10 years
- ❍ 11-15 years
- ❍ More than 15 years

Q5 What grade level do you teach/support? (Tick all that apply)
- ❑ Primary school
- ❑ Middle school
- ❑ High school

Q6 What subject areas do you teach? (Tick all that apply)
- ❑ Arts
- ❑ Capstone Project
- ❑ Humanities & Social Sciences
- ❑ Language Arts & Acquisition
- ❑ Library & Research Support
- ❑ Mathematics
- ❑ Physical, Health & Sports Education
- ❑ Sciences
- ❑ Technology & Design
- ❑ Student Support & Services

Q7 Please rate your WORD PROCESSING skills	Can Do	Wish I Could	Not Sure
Manipulate text: select, highlight, cut/copy/paste, change type appearance, fonts, size & style	❍	❍	❍
Create text boxes, use borders, columns, add tables, bullets & numbering	❍	❍	❍

Insert headers, footers, tables of content & appendices	❍	❍	❍
Use reference, thesaurus & language tools	❍	❍	❍
Personalize & use spellchecker as appropriate to task & as a learning tool	❍	❍	❍
Understand page orientation & document layout. Use print preview to eliminate duplicates & errors	❍	❍	❍
Work with a variety of office applications	❍	❍	❍

Q8 Please rate your GRAPHICS MANIPULATION skills	**Can Do**	**Wish I Could**	**Not Sure**
Understand that a presentation is clear, concise & logical	❍	❍	❍
Choose appropriate slide design & layout considering color palettes, type size & style, transitions	❍	❍	❍
Insert graphics from various sources e.g. clip art, digital images	❍	❍	❍
Select/delete/crop/copy, change size & properties of objects	❍	❍	❍
Use freehand drawing tools & color palettes. Use shape tools/objects & text tools	❍	❍	❍
Work with a variety of graphic manipulation applications	❍	❍	❍
Understand timing, can add sounds & work with a variety of audio recording & editing applications	❍	❍	❍
Understand multimedia file size & can work with a variety of video recording & editing applications	❍	❍	❍
Understand the use of importing, navigation & hyperlinks	❍	❍	❍

Q9 Please rate your SPREADSHEET skills	**Can Do**	**Wish I Could**	**Not Sure**
Understand terminology: column, row, cell, cell range	❍	❍	❍
Manipulate data formats such as currency, time, numerical values, type size & style	❍	❍	❍
Can alignment & adjust column width & row height	❍	❍	❍
Generate appropriate graphs e.g. bar, column, line	❍	❍	❍
Use sum formula & undertakes basic calculations	❍	❍	❍

Q10 Please rate your DATABASE MANAGEMENT skills	**Can Do**	**Wish I Could**	**Not Sure**
Understand basic terminology: fields, records & files	❍	❍	❍
Create relevant fields & choose appropriate data types for fields	❍	❍	❍
Sort data, add/delete records & edit existing records	❍	❍	❍
Open & use an academic & commercial online databases	❍	❍	❍
Locate information searching by subject, key word, author	❍	❍	❍
Work with a variety of referencing applications	❍	❍	❍

Q11 Please rate your RESEARCH MANAGEMENT skills	Can Do	Wish I Could	Not Sure
Understand the difference in browser use for general & academic purposes	❍	❍	❍
Select appropriate search sites & determine if information is current, accurate & reliable	❍	❍	❍
Understand & use key words in an advanced search	❍	❍	❍
Properly record, catalogue & cite electronic data references	❍	❍	❍

Q12 Please rate your LEARNING/CONTENT MANAGEMENT SYSTEM (L/CMS)	Can Do	Wish I Could	Not Sure
Access learning materials	❍	❍	❍
Upload assignments	❍	❍	❍
Participate in discussions using bulletin boards	❍	❍	❍
Participate in a webinar - audio & video real time discussions	❍	❍	❍
Take a quiz	❍	❍	❍
Access grades	❍	❍	❍

Q13 Please rate your COMMUNICATIONS APPLICATIONS skills	Can Do	Wish I Could	Not Sure
Understand the general structure, design & purpose of an academic email system	❍	❍	❍
Properly format, size & send attachments & uses hyperlinks & navigation buttons	❍	❍	❍
Create, organize & sort file storage folders by subject, date, contact & content	❍	❍	❍

Q14 Please rate your MULTIMEDIA & PRESENTATION HARDWARE skills	Can Use	Wish I Could Use	Not Sure
Audio recorders or players	❍	❍	❍
Desktop & laptop computers	❍	❍	❍
External storage drives, USB thumb drives, etc.	❍	❍	❍
Interactive whiteboards	❍	❍	❍
Modems or routers	❍	❍	❍
Printers, copiers or scanners	❍	❍	❍
Security digital (SD) cards or readers	❍	❍	❍
Smart phones	❍	❍	❍
Tablets or eReaders	❍	❍	❍
Webcams or microphones	❍	❍	❍
Video recorders or players	❍	❍	❍
Wireless, Bluetooth or tethering transmitters	❍	❍	❍

Q15 Please rate your INTERACTIVE APPLICATIONS skills	Can Do	Wish I Could Do	Not Sure
3D or animation software	❍	❍	❍
Games & gaming	❍	❍	❍
Language translation programs	❍	❍	❍
Content management systems	❍	❍	❍
Mapping & location programs	❍	❍	❍
Media streaming	❍	❍	❍
Social media, blogs & forums	❍	❍	❍
Virtual worlds	❍	❍	❍
Web development or editing tools	❍	❍	❍

Q16 Please rate your use of these OPERATING SYSTEMS	Can Use	Wish I Could Use	Not Interested
Android	❍	❍	❍
Apple	❍	❍	❍
Linux/Ubutu	❍	❍	❍
Windows	❍	❍	❍

Q17 Please indicate what ICT training is of interest to you for both professional and personal use. (Tick all that apply)

❑ Office suites: word processing, spreadsheets and data bases
❑ Offline presentation skills such as those used with Microsoft PowerPoint
❑ Offline multimedia skills such as those used with Adobe Photoshop
❑ Online skills such as those used to access email and otherwise interact with others via the Internet
❑ Online skills necessary to locate, retrieve, sort and store research data
❑ Online webpage creation and design
❑ Developing learning and content management systems (L/CMS)
❑ Other(s) ____________________

Thank you for completing this survey. Your responses are integral to the process of ICT integration in our school. Your time is valuable and with this data we will strive to create ICT programs that respect your time, your needs and your vision for your teaching experience. But most importantly, by supporting our staff ICT needs we will better prepare our students for an ICT future bright with promise.

Appendix 14: Best-practice criteria of summative assessment structure

Effective *summative* assessments of 21st century skills should:		**Example**
Focus on 21st century skills and content (as defined by the P21 Framework)	21st century subject matter includes, in addition to the standard core subjects, important areas of study such as global awareness, civic literacy, etc., and skills, such as ICT literacy, critical thinking, problem-solving, and life skills.	The K to the 8th Power Technology Literacy Assessment was developed to assist (Australian) teachers and administrators in determining 6th, 7th, and 8th graders' level of technology literacy.
Provide useful information about student achievement by measuring the comprehension, absorption and application of higher order concepts.	The assessment must be tied to previously-established learning goals for the teaching unit. Assessing unimportant or trivial concepts is not an effective way to assess student achievement.	The Cisco Networking Academy Program assessment and curricular teams work together to ensure that what is included in each assessment covers important parts of the curriculum and what the instructors teach is appropriately tested.
Be valid.	The assessment should measure what it is supposed to measure. Keeping questions short, to the point, and free of ambiguity is one way to assure this.	The Intermediate-Level Geography Test created by the National Council for Geography Education was revised and reassessed in 2000 to ensure content validity and reliability.
Be reliable.	The assessment should provide student scores that are not affected by arbitrary factors. For example, the number of items and answer options on a test should be high enough so that it is unlikely that a student can get a high score by simply guessing randomly.	The Civic Outcomes for Elementary School Students assessment is based on a set of valid and reliable measures of civic knowledge, skills, attitudes, and behaviors.
Be fair.	The assessment must give the same chance of success to all students. Take-home tests that require access to the Internet may unfairly favor students from higher-income families, for example.	The UK's Key Stage 3 ICT Literacy Assessment uses generic software programs developed by the QCA to provide the same capabilities as familiar productivity software on the level playing field of a nonbrand-specific platform.
Be administered widely.	This is important so that schools, districts, states, as well as countries can be informed as to whether learning has taken place. It also allows educators to make comparisons within and between successively larger populations of students (class, school, district, state, country).	The Program for International Student Assessment (PISA) is an internationally standardized assessment that is typically administered to 4,500-10,000 students in each country. Sixty-two countries have signed up to participate in the 4th assessment in 2009.

(P21stCentSkills, Partnership for 21st Century Skills e-paper, 2006, p. 5)

Appendix 15: Research Production Skills recommended for higher education

Recommended Application	Definition
ArchiCAD……………………......	3D design software made by architects for architects
AutoCAD……………………......	Software application for 2D and 3D computer-aided design (CAD) and drafting
BIM CAD……………………......	Generation and management of digital representations of physical and functional characteristics of places
C & C++………………………....	A general-purpose programming language
Camtasia & TechSmith…….	Screen-capturing and recording software
CircuitMaker…………………..	Free and easy-to-use tool for electronics design
COMSOL Multiphysics…….	An interactive environment for modelling and simulating scientific and engineering problems
CSS3……………………............	Style sheet language used for describing the presentation of a document written in a mark-up language
Eclipse…………………….…....	Frameworks and tools used for the development of embedded automotive software
Fortran………………………...	Fortran is a programming language mainly used by the scientific community
GanttProject…………………..	Free project scheduling and management application
LabVIEW…………………….....	A system-design platform and development environment for a visual programming
LAMS……………………...........	Visual authoring environment for creating sequences of learning activities
Mahara……………………….....	Fully featured web application to build your electronic portfolio
MathCast…………………….....	Graphical mathematics equation editor
Mathematica…………………	Computational software program used in many scientific, engineering, mathematical and computing fields, based on symbolic mathematics
MATLAB……………………......	Computing language and interactive environment for algorithm development, data visualization, data analysis, and numerical computation
Minecraft in UDK…………….	Intro-level design and editor for designing 3D game levels
NetBeans……………………....	Software development platform written in Java
NeuroSky……………………....	Monitoring and analysis for consumer-facing, wearable technology
Omnium Software………….	Interfaces for creating online communities, networks and e-learning
Python…………………………...	Easy to learn, powerful programming language
Rhino & Grasshopper………	Grasshopper™ is a graphical algorithm editor tightly integrated with Rhino's 3-D modelling tools
Sandbox………………………....	Testing environment that isolates untested code changes and outright experimentation
Simulink………………………....	Graphical programming environment for modelling, simulating and analyzing multi-domain dynamic systems
SPSS…………………….............	Statistics is a software package used for statistical analysis
Statcast……………………….....	Statistical analysis
TopHat Monocle…………….	Classroom engagement and interactive teaching platform
Unity……………………...........	Cross-platform game engine used to develop video games for PC, consoles, mobile devices and websites
Unity 3D…………………….....	Cross-platform game development platform
VoiceThread…………………..	Web-based application that allows placement of media like images, videos, documents, and presentations at the center of an asynchronous conversation.
VPI TransmissionMaker & VPIcomponentMaker…….	Flexible software environment for optical component and systems design

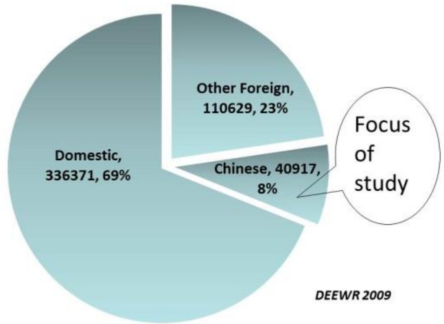
Appendix 16: World Conference on Computers in Education 2013 – Poster Presentation

UTAS
FACULTY OF EDUCATION
School of Education

WCCE 2013
The Use & Users of ICT in Australian Higher Education

Janet Price-Glick, MSc, BS, PhD student, University of Tasmania; Andrew Fluck, BSc, GradCert Ed, Med, TTC, University of Tasmania; and Darren Pullen, BN, Grad Dip Admin & Info Sys, Bed, MA(Ed), MMedSci, PhD, University of Tasmania

Origin of commencing students at Australian universities



DEEWR 2009

- ICT skills facilitate the exchange of knowledge
- ICT skills are ubiquitous in western curriculum
- ICT are not used in Chinese P-12 education

Elite English language high school classroom, Suzhou, China, 2013

OBJECTIVES

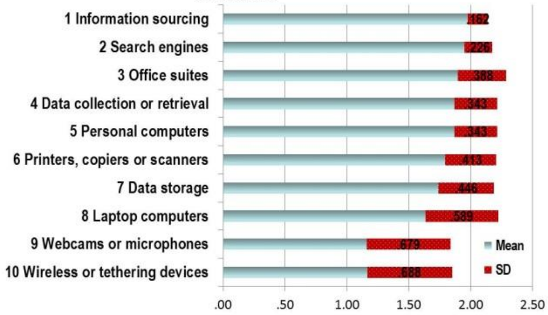
- Identify and codify ICT skills expected by Australian lecturers
- Model ICT use of the Chinese P-12 student
- Identify discrepancies

METHOD

- Ground theory in historic context
- Review recent and emerging literature
- Survey Australian university personnel
- Interview foreign teachers and graduates

Preliminary RESULTS

Top-10 ICT skills expected by Australian lecturers



Pilot Survey 2012

DISCUSSION

- Is there a need for an ICT assessment tool?
- Will ICT remediation improve student performance?

CONCLUSIONS

Emerging literature confirms that Chinese students lack university-level ICT skills.

SOLUTIONS

- Universities should identify and communicate required ICT skills
- Universities should support students needing skills remediation

For additional information contact: Janet.PriceGlick@utas.edu.au

Appendix 17: *SurveyP-12* Data Master

	Survey of Primary through Secondary Analyses Statistics	Frequency Statistics				Goodness of Fit			Exploratory Factor Analysis					Principle Components Analysis	
		Yes %	Yes	No	No Opinion	Chi-square 0 >5	Asymp. Sig.	Cronbach Alpha	Mean	Standard Deviation	Variance	Skewness	Kurtosis	Correlation Matrix	80.357% variance
1	Word processing-select/highlight/cut/copy/paste	79%	101	9	18	119	.000	.968	2.68	.681	.516	-3.753	13.067	.751	0.816
2	Word processing-create text boxes/borders/columns	67%	84	17	24	64	.000	.968	2.50	.782	.642	-1.840	1.831	.638	0.667
3	Word processing-reference/thesaurus/language tools	74%	93	13	19	95	.000	.967	2.63	.707	.550	-2.711	6.115	.739	0.728
4	Word processing-page orientation & document layout	74%	92	11	21	94	.000	.967	2.60	.738	.588	-1.964	2.190	.783	0.763
5	Multimedia-clear/concise/logical presentations	73%	92	16	18	124	.000	.968	2.70	.633	.420	-1.607	1.009	.799	0.755
6	Multimedia-effective presentation design/layout	77%	96	16	13	79	.000	.967	2.59	.700	.553	-1.782	1.778	.767	0.789
7	Multimedia-graphics/clip art/images in presentations	80%	101	12	13	106	.000	.967	2.68	.623	.435	-3.042	8.362	.813	0.775
8	Multimedia-select/delete/crop/copy	71%	89	18	19	89	.000	.967	2.61	.697	.532	-1.882	2.110	.790	0.779
9	Spreadsheets-terminology: column/row/cell	50%	65	37	27	18	.000	.967	2.27	.796	.631	-1.750	1.618	.863	0.769
10	Spreadsheets-alignment/adjust column/rows	52%	66	35	27	20	.000	.967	2.28	.799	.639	-1.089	-.399	.898	0.806
11	Spreadsheets-generate graphs/charts	45%	57	41	30	9	.013	.967	2.20	.794	.640	-1.525	.850	.911	0.779
12	Spreadsheets-formulae & basic calculations	44%	55	43	28	9	.013	.968	2.19	.779	.618	-1.446	.604	.910	0.8
13	Research & data-advance search subject/key word/author	53%	68	36	24	62	.000	.967	2.51	.732	.560	-1.400	.379	.872	0.775
14	Research & data-select search sites/accurate information	53%	67	38	22	50	.000	.967	2.47	.731	.561	-1.047	-.592	.854	0.785
15	Research & data-record/catalogue/cite references	66%	86	25	20	37	.000	.967	2.43	.728	.561	-2.245	3.664	.874	0.797
16	Research & data-terminology: fields/records	62%	81	29	20	24	.000	.967	2.34	.764	.605	-5.285	27.916	.825	0.823
17	Research & data-sort data, add/delete records	58%	74	34	20	25	.000	.967	2.34	.752	.580	-.901	-.714	.820	0.781
18	Research & data-uses hyperlinks & navigation	56%	72	34	22	32	.000	.967	2.38	.760	.586	-4.787	22.696	.840	0.802
19	Interactive applications-3D animation	35%	43	51	29	61	.000	.968	2.48	.805	.650	.141	-.875	.842	0.653
20	Interactive applications-ESL & translation	56%	69	29	25	67	.000	.968	2.49	.793	.626	.124	-1.110	.854	0.706
21	Interactive applications-mapping & GPS	49%	61	34	29	76	.000	.967	2.55	.755	.581	.088	-1.319	.861	0.768
22	Interactive applications-social media	68%	84	20	20	24	.000	.968	2.32	.796	.624	-.466	-1.173	.752	0.538

	Survey of Primary through Secondary Analyses Statistics	Frequency Statistics				Goodness of Fit			Exploratory Factor Analysis					Principle Components Analysis	
		Yes %	Yes	No	No Opinion	Chi-square 0 >5	Asymp. Sig.	Cronbach Alpha	Mean	Standard Deviation	Variance	Skewness	Kurtosis	Correlation Matrix	80.357% variance
23	Interactive applications-web design	32%	39	53	30	47	.000	.968	2.43	.802	.641	.027	-1.151	.768	0.614
24	Hardware-PCs & laptop	66%	83	18	25	6	.049	.968	2.08	.741	.577	-7.190	50.557	.677	0.753
25	Hardware-USB & file storage	68%	84	17	23	29	.000	.968	2.35	.790	.641	-2.877	6.639	.742	0.795
26	Hardware-print/copy/scan	70%	86	16	20	14	.001	.968	2.25	.802	.665	-2.359	3.838	.827	0.759
27	Hardware-tablets	54%	66	32	24	66	.000	.968	2.51	.757	.577	-.298	-1.579	.728	0.703
28	Hardware-webcams	63%	77	22	24	7	.037	.968	2.05	.745	.565	-.213	-1.601	.592	0.819

Appendix 18: *SurveyHE* Data Master

		Frequency Statistics				Goodness of Fit			Exploratory Factor Analysis					Principle Components Analysis	
	Survey of Higher Education Analyses Statistics	Yes %	Yes	No	No Opinion	Chi-square 0 >5	Asymp. Sig.	Cronbach Alpha	Mean	Standard Deviation	Variance	Skewness	Kurtosis	Correlation Matrix	65.15% variance
1	Word processing-select/highlight/cut/copy/paste	92%	328	13	14	557	.000	.864	2.88	.426	.182	-3.753	13.067	.626	0.543
2	Word processing-create text boxes/borders/columns	79%	279	36	38	332	.000	.861	2.68	.658	.433	-1.840	1.831	.663	0.39
3	Word processing-reference/thesaurus/language tools	87%	307	25	21	457	.000	.867	2.81	.523	.274	-2.711	6.115	.432	0.327
4	Word processing-page orientation & document layout	82%	288	25	40	371	.000	.864	2.70	.661	.437	-1.964	2.190	.587	0.388
5	Multimedia-clear/concise/logical presentations	89%	312	25	15	283	.000	.860	2.63	.691	.478	-1.607	1.009	.640	0.67
6	Multimedia-effective presentation design/layout	79%	279	42	33	306	.000	.862	2.68	.637	.406	-1.782	1.778	.728	0.695
7	Multimedia-graphics/clip art/images in presentations	77%	273	48	33	485	.000	.862	2.84	.467	.218	-3.042	8.362	.695	0.673
8	Multimedia-select/delete/crop/copy	76%	266	43	43	330	.000	.861	2.69	.632	.400	-1.882	2.110	.681	0.709
9	Spreadsheets-terminology: column/row/cell	77%	270	46	35	301	.000	.859	2.67	.650	.422	-1.750	1.618	.860	0.873
10	Spreadsheets-alignment/adjust column/rows	65%	229	65	57	161	.000	.859	2.49	.759	.576	-1.089	-.399	.732	0.864
11	Spreadsheets-generate graphs/charts	73%	258	54	40	254	.000	.859	2.62	.681	.464	-1.525	.850	.876	0.799
12	Spreadsheets-formulae & basic calculations	72%	253	57	42	236	.000	.860	2.60	.693	.480	-1.446	.604	.848	0.868
13	Research & data-advance search subject/key word/author	83%	290	32	27	235	.000	.864	2.58	.719	.517	-1.400	.379	.829	0.883
14	Research & data-select search sites/accurate information	96%	334	8	7	167	.000	.864	2.47	.792	.627	-1.047	-.592	.787	0.832
15	Research & data-record/catalogue/cite references	95%	329	10	8	389	.000	.868	2.75	.584	.341	-2.245	3.664	.682	0.78
16	Research & data-terminology: fields/records	72%	253	51	48	611	.000	.868	2.94	.315	.099	-5.285	27.916	.775	0.831
17	Research & data-sort data, add/delete records	66%	231	54	66	112	.000	.861	2.43	.765	.586	-.901	-.714	.517	0.827
18	Research & data-uses hyperlinks & navigation	80%	280	24	48	590	.000	.867	2.93	.340	.116	-4.787	22.696	.761	0.854
19	Interactive applications-3D animation	19%	66	183	104	61	.000	.869	1.89	.687	.471	.141	-.875	.538	0.652
20	Interactive applications-ESL & translation	23%	80	162	108	30	.000	.869	1.92	.730	.532	.124	-1.110	.465	0.545
21	Interactive applications-mapping & GPS	27%	96	141	114	9	.012	.866	1.95	.773	.597	.088	-1.319	.404	0.537

	Survey of Higher Education Analyses Statistics	Frequency Statistics				Goodness of Fit			Exploratory Factor Analysis					Principle Components Analysis	
		Yes %	Yes	No	No Opinion	Chi-square 0 >5	Asymp. Sig.	Cronbach Alpha	Mean	Standard Deviation	Variance	Skewness	Kurtosis	Correlation Matrix	65.15% variance
22	Interactive applications-social media	45%	160	122	71	34	.000	.866	2.25	.770	.593	-.466	-1.173	.363	0.535
23	Interactive applications-web design	26%	92	161	98	25	.000	.869	1.98	.737	.543	.027	-1.151	.490	0.621
24	Hardware-PCs & laptop	98%	346	1	6	665	.000	.868	2.96	.264	.070	-7.190	50.557	.711	0.443
25	Hardware-USB & file storage	89%	315	11	26	500	.000	.865	2.82	.544	.296	-2.877	6.639	.718	0.554
26	Hardware-print/copy/scan	86%	305	14	35	446	.000	.865	2.76	.616	.380	-2.359	3.838	.497	0.438
27	Hardware-tablets	45%	161	86	107	25	.000	.865	2.15	.858	.736	-.298	-1.579	.647	0.443
28	Hardware-webcams	43%	151	92	112	15	.000	.864	2.11	.855	.731	-.213	-1.601	.693	0.54

Appendix 19: *SurveyP-12* Leximancer Data

Leximancer Word and/or Concept Frequency Chart - Survey of Primary through Secondary Teachers

Word or Concept	Frequency Total	Chinese	classroom	computer	course	courses	data	education	effective	experience	foreign	ICT	important	issue	issues	kids	knowledge	language	learn	learning	level	media	need	online	personal	programs	required	research	school	schools	skills	students	study	teacher	teachers	teaching	time	university	use	using	work
Chinese	17		1	2	0	1	0	0	1	1	0	4	2	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	3	4	0	6	0	1	2	1	0	1	1	0	0
classroom	15	1		3	0	0	0	1	2	0	0	3	1	1	1	0	0	1	0	1	1	3	1	0	1	0	0	0	0	2	1	2	0	4	2	0	1	0	2	1	1
computer	26	2	3		0	3	0	2	0	2	0	3	1	0	1	3	2	2	0	4	0	1	2	2	0	0	0	0	2	1	2	5	1	4	2	2	2	1	2	3	1
course	14	0	0	0		1	0	0	0	0	0	3	0	0	0	0	0	1	0	1	1	0	0	1	0	0	0	0	1	1	2	4	0	0	0	0	1	0	1	0	0
courses	12	1	0	3	1		0	0	0	1	0	5	1	0	0	0	1	1	0	2	0	0	2	0	0	0	0	1	2	1	2	3	0	0	0	0	1	0	1	0	0
data	7	0	0	0	0	0		1	0	0	0	1	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0	0
education	19	0	1	2	0	0	1		1	2	0	3	3	0	0	0	0	1	2	2	1	0	2	5	0	1	1	0	0	0	2	5	0	3	0	1	1	0	3	0	0
effective	6	1	2	0	0	0	0	1		2	0	1	1	0	0	0	0	0	2	1	0	2	1	0	0	1	1	0	0	0	1	1	0	1	1	1	1	0	0	0	0
experience	23	1	0	2	0	1	0	2	2		1	9	1	0	0	0	0	1	1	3	1	0	3	3	1	1	2	0	1	1	2	9	0	1	1	4	1	2	2	0	0
foreign	11	0	0	0	0	0	0	0	0	1		8	0	1	0	0	1	2	1	0	3	0	0	0	1	0	0	1	1	1	7	11	1	0	1	0	0	1	1	0	0
ICT	70	4	3	3	3	5	1	3	1	9	8		3	3	4	1	7	5	1	7	5	3	7	0	2	1	1	3	1	4	19	30	1	1	6	3	2	2	10	2	2
important	17	2	1	1	0	1	0	3	1	1	0	3		1	0	1	2	1	1	3	2	0	1	1	0	1	2	1	1	0	5	3	1	1	0	1	1	2	0	2	1
issue	11	0	1	0	0	0	0	0	0	0	1	3	1		0	0	1	1	0	0	1	1	0	0	0	0	1	0	0	0	1	1	0	0	2	0	1	0	0	0	1
issues	14	0	1	1	0	0	0	0	0	0	0	4	0	0		1	0	1	0	1	0	1	0	0	2	0	0	0	0	0	0	3	1	0	1	0	1	0	2	0	1
kids	10	0	0	3	0	0	0	0	0	0	0	1	1	0	1		0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	3	1	0	1	0	0	0	1	1	0
knowledge	12	1	0	2	0	1	0	0	0	0	1	7	2	1	0	0		0	0	0	0	0	1	1	1	0	0	2	1	1	3	3	1	0	1	0	0	1	2	0	0
language	17	0	1	2	1	1	2	1	0	1	2	5	1	1	1	0	0		3	5	1	1	1	0	0	0	0	2	1	1	4	8	2	0	0	2	1	0	2	1	3
learn	14	0	0	0	0	0	0	2	2	1	1	1	1	0	0	1	0	3		2	1	2	1	0	0	0	1	0	1	1	3	2	1	1	0	1	0	1	2	0	1
learning	35	0	1	4	1	2	1	2	1	3	0	7	3	0	1	1	0	5	2		2	1	4	2	0	2	0	2	0	1	6	8	0	2	1	4	1	2	4	2	0
level	12	0	1	0	1	0	0	1	0	1	3	5	2	1	0	0	0	1	1	2		1	0	1	0	0	1	1	0	2	5	5	0	0	0	1	0	2	1	1	3
media	11	0	3	1	0	0	0	0	2	0	0	3	0	1	1	0	0	1	2	1	1		0	0	0	0	0	0	0	0	3	3	0	0	2	1	0	0	3	1	1
need	28	2	1	2	0	2	0	2	1	3	0	7	1	0	0	1	1	1	1	4	0	0		0	0	2	0	0	0	2	3	9	0	1	3	1	1	0	4	1	1
online	19	0	0	2	1	0	0	5	0	3	0	0	1	0	0	0	1	0	0	2	1	0	0		1	1	1	1	0	1	1	6	1	0	0	2	0	3	4	1	1
personal	12	0	1	0	0	0	0	0	0	1	1	2	0	0	2	0	1	0	0	0	0	0	0	1		0	0	2	0	0	2	5	1	0	1	1	0	0	2	1	2
programs	9	0	0	0	0	0	0	1	1	1	0	1	1	0	0	0	0	0	0	2	0	0	2	1	0		1	0	0	0	3	1	1	1	0	0	1	1	2	1	0
required	7	0	0	0	0	0	0	1	1	2	0	1	2	1	0	0	0	0	1	0	1	0	0	1	0	1		0	0	0	1	1	1	1	0	1	0	1	1	0	2
research	16	0	0	0	0	1	1	0	0	0	1	3	1	0	0	0	2	2	0	2	1	0	0	1	2	0	0		0	0	8	4	0	0	1	0	0	0	3	1	0
school	12	3	0	2	1	2	0	0	0	1	1	1	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0		1	0	8	2	0	1	0	1	0	1	0	0
schools	11	4	2	1	1	1	0	0	0	1	1	4	0	0	0	0	1	1	1	1	2	0	2	1	0	0	0	0	1		1	3	0	0	0	1	0	1	0	0	0
skills	50	0	1	2	2	2	1	2	1	2	7	19	5	1	0	0	3	4	3	6	5	3	3	1	2	3	1	8	0	1		17	2	0	2	2	3	2	7	3	2
students	107	6	2	5	4	3	1	5	1	9	11	30	3	1	3	3	3	8	2	8	5	3	9	6	5	1	1	4	8	3	17		3	2	9	5	3	6	10	4	4
study	10	0	0	1	0	0	0	0	0	0	1	1	1	0	1	1	1	2	1	0	0	0	0	1	1	1	1	0	2	0	2	3		0	1	0	0	1	2	0	1
teacher	16	1	4	4	0	0	0	3	1	1	0	1	1	0	0	0	0	0	1	2	0	0	1	0	0	1	1	0	0	0	0	2	0		1	0	2	0	1	0	1
teachers	20	2	2	2	0	0	0	0	1	1	1	6	0	2	1	1	1	0	0	1	0	2	3	0	1	0	0	1	1	0	2	9	1	1		0	0	2	2	0	1
teaching	12	1	0	2	0	0	0	1	1	4	0	3	1	0	0	0	0	2	1	4	1	1	1	2	1	0	1	0	0	1	2	5	0	0	0		0	2	1	0	1
time	16	0	1	2	1	1	0	1	1	1	0	2	1	1	1	0	0	1	0	1	0	0	1	0	0	1	0	0	1	0	3	3	0	2	0	0		0	1	0	1
university	18	1	0	1	0	0	0	0	0	2	1	2	2	0	0	0	1	0	1	2	2	0	0	3	0	1	1	0	0	1	2	6	1	0	2	2	0		1	0	2
use	52	1	2	2	1	1	0	3	0	2	1	10	0	0	2	1	2	2	2	4	1	3	4	4	2	2	1	3	1	0	7	10	2	1	2	1	1	1		3	3
using	16	0	1	3	0	0	0	0	0	0	0	2	2	0	0	1	0	1	0	2	1	1	1	1	1	1	0	1	0	0	3	4	0	0	0	0	0	0	3		3
work	21	0	1	1	0	0	0	0	0	0	0	2	1	1	1	0	0	3	1	0	3	1	1	1	2	0	2	0	0	0	2	4	1	1	1	1	1	2	3	3	

Appendix 20: *SurveyHE* Leximancer Data

Leximancer Word and/or Concept Frequency Chart - Survey of Higher Education Instructors

Word or Concept	Frequency Total	assessment	classroom	computer	content	course	data	develop	education	experience	ICT	important	issue	issues	language	LCMS	learning	level	media	need	online	personal	program	programs	range	requires	research	skills	students	support	teacher	teaching	time	training	university	use	using	work
assessment	**8**		0	0	1	0	0	1	0	1	1	0	0	0	0	0	1	0	0	2	0	0	0	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0
classroom	**7**	0		2	1	0	0	0	1	0	1	0	0	0	0	1	1	1	1	0	0	1	0	0	1	1	0	1	1	0	2	0	1	0	0	2	1	1
computer	**12**	0	2		0	0	0	0	2	1	0	0	0	1	0	0	3	0	0	1	1	0	1	0	0	1	0	2	0	0	2	1	2	2	1	0	1	1
content	**7**	1	1	0		0	0	1	0	0	1	0	0	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
course	**9**	0	0	0	0		0	1	0	0	2	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	2	2	1	0	0	0	0	0	1	0	0
data	**7**	0	0	0	0	0		1	1	0	1	0	0	0	2	0	1	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0
develop	**7**	1	0	0	1	1	1		1	1	2	0	0	0	2	0	2	0	0	0	2	0	0	1	0	1	1	3	2	1	1	2	1	0	0	2	0	1
education	**15**	0	1	2	0	0	1	1		2	3	0	0	0	1	0	1	0	0	0	5	0	0	0	1	0	0	1	2	1	1	1	1	0	0	2	0	1
experience	**14**	1	0	1	0	0	0	1	2		6	0	0	0	0	0	3	1	0	2	3	0	0	1	0	0	0	1	4	0	0	1	1	0	2	1	0	1
ICT	**36**	1	1	0	1	2	1	2	3	6		1	2	0	3	1	5	3	1	3	0	0	0	1	1	1	1	7	7	0	0	1	0	4	0	5	1	3
important	**8**	0	0	0	0	0	0	0	0	0	1		1	0	1	2	1	2	0	1	0	0	0	1	0	0	0	4	0	0	0	1	1	0	1	0	1	1
issue	**8**	0	0	0	0	0	0	0	0	0	2	1		0	1	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	0	1	1	0	0	0	1
issues	**10**	0	0	1	0	0	0	0	0	0	0	0	0		1	0	1	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1
language	**11**	0	0	0	0	0	2	2	1	0	3	1	1	1		0	3	1	0	0	0	0	0	0	0	1	1	2	2	0	0	1	0	0	0	0	0	2
LCMS	**10**	0	1	0	1	0	0	0	0	0	1	2	0	0	0		2	0	0	0	0	0	0	0	0	0	1	3	3	0	0	0	0	2	1	2	0	0
learning	**31**	1	1	3	1	1	1	2	1	3	5	1	0	1	3	2		1	0	4	2	0	2	2	2	1	1	3	5	1	2	4	1	0	2	2	1	0
level	**10**	0	1	0	0	1	0	0	0	1	3	2	1	0	1	0	1		1	0	1	0	0	0	1	1	1	3	3	1	0	1	0	2	2	1	1	3
media	**8**	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1		0	0	0	0	0	0	2	0	3	1	1	0	1	0	0	0	2	0	1
need	**15**	2	0	1	0	0	0	0	0	2	3	1	0	0	0	0	4	0	0		0	0	1	1	0	0	0	1	4	0	0	0	2	0	0	2	0	0
online	**16**	0	0	1	1	1	0	2	5	3	0	0	0	0	0	0	2	1	0	0		1	0	1	1	0	0	1	6	4	0	2	0	0	3	4	1	1
personal	**9**	0	1	0	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	1		0	0	0	0	0	0	2	0	0	0	0	0	0	1	1	2
program	**6**	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	0		0	0	0	0	1	1	0	0	0	2	0	0	1	0	0
programs	**8**	2	0	0	0	0	0	1	0	1	1	1	0	0	0	0	2	0	0	1	1	0	0		0	0	0	2	1	2	0	0	1	0	1	1	1	0
range	**7**	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	2	1	0	0	1	0	0	0		0	0	1	2	1	0	1	0	0	0	0	2	1
requires	**5**	0	1	1	0	0	0	1	0	0	1	0	1	0	1	0	1	1	2	0	0	0	0	0	0		0	2	1	1	0	2	0	2	1	0	0	0
research	**10**	0	0	0	0	0	1	1	0	0	1	0	0	0	1	1	1	1	0	0	0	0	0	0	0	0		4	1	1	0	0	0	0	0	0	0	0
skills	**31**	0	1	2	0	2	1	3	1	1	7	4	1	0	2	3	3	3	3	1	1	0	1	2	1	2	4		4	3	0	2	3	1	0	4	2	1
students	**52**	1	1	0	0	2	1	2	2	4	7	0	0	1	2	3	5	3	1	4	6	2	1	1	2	1	1	4		4	0	3	0	3	2	7	2	3
support	**12**	1	0	0	0	1	0	1	1	0	0	0	1	0	0	0	1	1	1	0	4	0	0	2	1	1	1	3	4		0	1	0	1	2	3	0	0
teacher	**9**	0	2	2	0	0	0	1	1	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0		0	2	0	0	1	0	1
teaching	**7**	0	0	1	0	0	0	2	1	1	1	1	0	0	1	0	4	1	1	0	2	0	0	0	1	2	0	2	3	1	0		0	0	2	1	0	1
time	**12**	0	1	2	0	0	0	1	1	1	0	1	1	1	0	0	1	0	0	2	0	0	2	1	0	0	0	3	0	0	2	0		0	0	1	0	1
training	**12**	0	0	2	0	0	0	0	0	0	4	0	1	0	0	2	0	2	0	0	0	0	0	0	0	2	0	1	3	1	0	0	0		1	0	0	0
university	**11**	0	0	1	0	0	0	0	0	2	0	1	0	0	0	1	2	2	0	0	3	0	0	1	0	1	0	0	2	2	0	2	0	1		0	0	1
use	**32**	0	2	0	1	1	0	2	2	1	5	0	0	0	0	2	2	1	2	2	4	1	1	1	0	0	0	4	7	3	1	1	1	0	0		0	2
using	**11**	0	1	1	1	0	1	0	0	0	1	1	0	0	0	0	1	1	0	0	1	1	0	1	2	0	0	2	2	0	0	0	0	0	0	0		2
work	**15**	0	1	1	0	0	0	1	1	1	3	1	1	1	2	0	0	3	1	0	1	2	0	0	1	0	0	1	3	0	1	1	1	0	1	2	2	